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ABSTRACT

This is one of five performance-based secondary level guides for vocational education. Part 1 provides tools, resources, and a process to be used at the local level to develop a firefighter cadet training curriculum. It includes a comprehensive overview of the career field; a performance-based listing of firefighting job tasks; a description of the attitudes and values inherent in firefighting; a method for developing learning activity packages; two sample learning activity packages; descriptions of eight commonly used teaching methods; and a listing of instructional resources. Part 2 offers the guidance counselor career information and recommends steps to determine criteria for student selection and placement in the training program. It includes a theoretical framework for guidance activities; a description of the general aptitude test battery; a composite profile of the entry-level worker; a listing of the instructional units of a widely used remediation program; the Worker Trait Codification System (from the "Dictionary of Occupational Titles"); descriptions of related jobs; and job titles associated with the principal worker trait group identified for the entry-level worker. (NJ)

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# TEACHING GUIDE FOR FIRE CADET OCCUPATIONS

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# PREFACE

This teaching guide is linked to a national vocational information system which is performance-based and employer-based. It offers the secondary-level instructor, guidance counselor, student, and administrator the results of an occupational analysis of the career field and presents a core of resources for use in developing a training curriculum at the local level. It also provides a description of the basic competencies required for advancement within the field.

The guide presents the instructor and student with statements of the actual job skills required to perform at the entry level and is backed by the knowledge requirements of the firefighting field. For the curriculum designer, the guide provides a logical system of information—job tasks, general knowledge concepts, a suggested instructional methodology, sample learning activity packages, and teaching resources—that is adaptable to local school needs and resources. For the guidance counselor, the guide offers information and suggestions for determining the prerequisite learning needs of individual students and recommends diagnostic tools for placing students in the training program. The school administrator can use the guide as a planning and evaluative tool to strengthen existing programs and develop new ones. All users of the guide should familiarize themselves with each section so that maximum use may be made of the guide in curriculum development efforts.

The guide is divided into two parts: Part One, "Guide for Curriculum and Instructional Development" (Sections 1.1–1.8), and Part Two, "Guide for Student Selection and Placement in the Training Program" (Sections 2.1–2.7).

## PART ONE: GUIDE FOR CURRICULUM AND INSTRUCTIONAL DEVELOPMENT

SECTION 1.1, "How to Use Part One of the Guide," presents a recommended, step-by-step method for using Sections 1.1–1.8. Included in the section are steps for: Background and Review, How to Plan Your Course, How to Develop Instructional Units, and Student Selection and Placement.

SECTION 1.2, "How the Guide Was Developed," explains the structure and development of the guide and the definitions of key concepts: occupational analysis, worker trait group, task statement, task inventory, general knowledge concept, and career ladder.

SECTION 1.3, "General Job Description: Firefighter," provides a comprehensive overview of the career field, descriptions of the type of work performed at the entry level, employment forecasts, and other important career information.

SECTION 1.4, "Inventory of Job Tasks," presents a performance-based listing of firefighting job tasks at the entry, intermediate, and advanced levels. The tasks represent the significant learner outcomes of the training program; they are the core materials upon which curriculum development efforts can be based.

SECTION 1.5, "Inventory of General Knowledge Concepts," describes the important attitudes and values inherent to firefighting. These concepts form the academic grounding for effective performance of the job tasks.

SECTION 1.6, "How to Develop Learning Activity Packages," explains a method for developing learning activity packages from the performance-based tasks and the knowledge-based concepts. Two sample learning activity packages are presented in this section: one based on a task and one based on a general knowledge concept.

SECTION 1.7, "How to Select an Instructional Method," describes the uses, advantages, and disadvantages of eight of the most commonly used instructional methods and the factors involved in selecting the most appropriate method for a given learning situation.

SECTION 1.8, "Teaching-Learning Resources for the Instructor," provides the instructor with a variety of instructional resources and references for use in curriculum and instructional development efforts.

## PART TWO: GUIDE FOR STUDENT SELECTION AND PLACEMENT IN THE TRAINING PROGRAM

SECTION 2.1, "How to Use Part Two of the Guide," offers the school guidance counselor a step-by-step method for using Sections 2.1–2.7.

SECTION 2.2, "Career Guidance for Fire Cadet Occupations," provides a theoretical framework for guidance activities in the training program and describes the General Aptitude Test Battery which can be used for student selection and placement.

SECTION 2.3, "Qualifications Profile for the Entry-Level Fire Cadet," presents a composite profile of the entry-level worker and is based on worker traits associated with this career field from the Dictionary of Occupational Titles.

SECTION 2.4, "The Advanced General Education Program," lists the instructional units contained in a widely used remediation program.

SECTION 2.5, "Worker Trait Codification System," is excerpted from the Dictionary of Occupational Titles and provides an explanation of all the knowledge, aptitude, and interest levels associated with worker trait groups.

SECTION 2.6, "Related Jobs at Entry, Intermediate, and Advanced Levels," is included in the guide to suggest the job and career mobility that results from training as a fire cadet.

SECTION 2.7, "Related Jobs by Worker Trait Group," presents job titles associated with the principal worker trait group identified for the entry-level worker.

# PART ONE

# GUIDE FOR CURRICULUM
# AND
# INSTRUCTIONAL DEVELOPMENT

# SECTION 1.1
## How to Use Part One of the Guide

Part One of the guide provides tools, resources, and a step-by-step process that can be used at the local secondary school level to develop a firefighter cadet training curriculum and supporting instructional activities. The steps listed below present a recommended method for using the sections in Part One of the guide. The user is encouraged to follow these steps so that the best possible use of the guide can be made.

The **Background and Review** steps provide the user with a comprehensive overview of the firefighting field and an explanation of the procedures used to develop the guide. The steps included in **How to Plan Your Course** offer a detailed procedure for using key sections of Part One to develop an up-to-date, job-related curriculum. The steps under **How to Develop Instructional Units** build on the course-planning steps and provide useful models for the development of learning activity packages which are responsive to local needs. The **Student Selection and Placement** steps offer suggestions to the instructor for coordinating course development activities with the student selection and placement activities of the school guidance counselor.

### BACKGROUND AND REVIEW

**STEP 1: Review how the guide was developed.** Read Section 1.2, "How the Guide Was Developed," to gain a thorough understanding of the structure and development of the guide and to become familiar with these key concepts and terms: occupational analysis, worker trait group, task statement, task inventory, general knowledge concept, and career ladder.

**STEP 2: Review the information on the firefighting career field.** Read Section 1.3, "General Job Description: Firefighter," for an overview of the career field, descriptions of the type of work performed, employment forecasts, and other important career information.

**STEP 3: Review the Inventory of Job Tasks.** Study Section 1.4, "Inventory of Job Tasks," to gain another perspective on the career field. This section presents a performance-based listing of firefighter job tasks at the entry, intermediate, and advanced levels. These tasks represent the significant learner outcomes of the training program; they are the core materials upon which curriculum development efforts can be based.

**STEP 4: Review the Inventory of General Knowledge Concepts.** Study Section 1.5, "Inventory of General Knowledge Concepts," to become familiar with the knowledge-based concepts that support the performance-based tasks.

### HOW TO PLAN YOUR COURSE

**STEP 1: Examine each entry-level task.** The entry-level tasks form the building blocks of a performance-based curriculum. Consider what is meant by each task statement listed in the Inventory of Job Tasks (Section 1.4), how it differs from other task statements in the inventory, and how it relates to: the needs of your student population; the educational priorities of your school; the facilities, equipment, and instructional materials available; and the time available for instruction.

**STEP 2: Rank the tasks in the order of their importance.** Keeping in mind the educational priorities, needs, and resources of your school and students, rank all the entry-level tasks in the order of their importance. Your first efforts should be to divide the tasks into more manageable clusters, such as: 1 = most important, 2 = average importance, and 3 = less important. Then, rank the tasks within each of these clusters. The end result of this effort is a ranked list of task statements ranging from most important to least important with regard to your educational priorities, needs, and resources. If an advisory committee or another group of educators is involved in course planning, their ranking of the tasks should be done independently.

**STEP 3: Independently rerank the tasks.** After a short period of time has elapsed (one or two weeks), each advisory committee member or other persons who ranked tasks should repeat Steps 1 and 2. Do not refer to your initial rankings during this step.

**STEP 4: Resolve any differences in the task rankings.** In order to improve the reliability of the rankings, resolve any differences through group discussions among the rankers and a reexamination of the tasks.

**STEP 5: Review your ranked entry-level task list.** For the finalized, ranked list of tasks, determine if you have a manageable number of tasks to teach in the time allotted for the training program. Drop the lowest ranked tasks until a manageable number of tasks is reached.

**STEP 6: Sequence your entry-level task list.** Sequence the tasks in the approximate order in which they will be taught. (The sequence may be slightly altered when you begin developing instructional units based on the tasks.) There are two basic ways to sequence tasks: one is based on the order in which the tasks are performed on the job, and the other is based on a building block concept. These two methods are described in more detail below. In actual practice, both sequencing methods have their place in course development. Deciding which method to use will depend on the content and performance required in a particular task or group of tasks.

- Method 1: Job Performance Order. This method provides the student with training in performing a group of tasks as they actually would be performed on the job. The sequence may be determined through employer interviews, the establishment of an occupational advisory committee, or collaboration with local training directors or supervisors.

- Method 2: Building Block Learning. The building block method means that the initial, prerequisite skills and knowledge taught serve as basic building blocks for subsequent instruction. In general, a student should progress from the simple to the complex, from the familiar to the unfamiliar, and from the concrete to the abstract. Easily learned tasks or broad concepts that have application throughout the course should be placed at the beginning of the course. Similarly, more complex tasks that depend on the mastery of several simpler tasks should be placed near the end of the course.

**STEP 7: Select general knowledge concepts for course content.** The general knowledge concepts (Section 1.5) relate to the important background knowledge required of firefighters. They form the academic grounding for effective performance of the job tasks. Since the general knowledge concepts relate to topics that may be taught in academic courses such as chemistry, physics, mathematics, and health, you may want to coordinate your selection of concepts with teachers of those courses.

**STEP 8: Develop additional general knowledge concepts.** Add your own concepts to those selected. This list of concepts supports the task list you developed in previous steps. When you have completed this step you will have two lists: (1) a sequenced list of performance-based entry-level tasks and (2) a list of general knowledge concepts which describe the academic grounding for effective performance of the tasks. These two lists form the content of your course.

**STEP 9: Insert the general knowledge concepts into your course sequence.** In Step 6 above you determined the approximate order in which the tasks will be taught in the course. Now, place the general knowledge concepts into that sequence so that they support the learning of the tasks.

**STEP 10: Contact fire departments in your local area.** In your course planning you should acquaint local firefighting personnel with your course of studies, approach, and instructional activities. They may be able to provide some useful suggestions about involving students in cooperative education programs, volunteer projects, and field trip activities.

## HOW TO DEVELOP INSTRUCTIONAL UNITS

**STEP 1: Review the basic principles of learning.** In Section 1.6, "How to Develop Learning Activity Packages," a list of basic learning principles is presented. Review the list to gain an understanding of these principles which support all types of learning activities. The principles may be applied to instructional units based on either the tasks or the general knowledge concepts you selected.

**STEP 2: Examine the process for developing learning activity packages.** Study Section 1.6 to become familiar with the process used to develop learning activity packages which utilize the performance-based tasks and the knowledge-based concepts. Section 1.6 provides two sample learning activity packages: one based on a task and one based on a general knowledge concept.

**STEP 3: Develop your own learning activity packages.** Design your own packages based on the process described in Section 1.6. Blank worksheets are provided at the end of Section 1.6 for this purpose.

**STEP 4: Select methods of instruction and supporting activities.** Use the following sections of the guide to support each learning activity package: Section 1.7, "How to Select an Instructional Method," and Section 1.8, "Teaching-Learning Resources for the Instructor."

## STUDENT SELECTION AND PLACEMENT

**STEP 1: Review the guidance sections in Part Two of the guide.** Review the sections in Part Two of the guide to gain an understanding of how the guidance activities relate to and support your curriculum and instructional development activities. It is especially important to review Section 2.3, "Qualifications Profile for the Entry-Level Firefighter Cadet."

**STEP 2: Coordinate your efforts with the school guidance counselor.** Discuss student selection and placement activities with the school guidance counselor in order to establish criteria for selection and placement of students in the training program.

# SECTION 1.2
## How the Guide Was Developed

The teaching guide for fire cadet occupations represents a significant step in the development of training programs that are closely linked with employer requirements and employment opportunities. It is based on the premise that students should be trained in the actual job skills identified by firefighting personnel and institutions for entry-level positions. Its aim is to put into the hands of educators at the local level a core of materials that can be used to develop a training program based on their needs and resources. This section of the guide describes the procedures used to develop the teaching guide and provides the background information needed for effective use of each section.

Development of the teaching guide began with the identification of a family of jobs within the field which were related through their required levels of performance and knowledge. Extensive use was made of the Dictionary of Occupational Titles (D.O.T.),* U.S. Civil Service Commission documents, and related supplements in identifying job families.

The criteria used for selecting jobs that would, in effect, define the field included:

**Broad Entry-Level Tasks.** Jobs were selected which required the performance of a broad range of entry-level skills and knowledge when compared to related jobs.

**Job Mobility.** Jobs were selected that entailed skills and knowledge which could be applied to jobs higher on a career ladder concept beginning at the semi-skilled or entry level and proceeding upward, job by job, to the advanced level. Jobs that did not provide an opportunity for upward mobility within the career field were screened out.

**Career Flexibility.** Job skills and knowledge which could be applied to jobs outside the field were selected. This criterion reflected concern for students who might partially or entirely finish the training program and then decide to enter another career field.

**Future Employment Opportunities.** Available employment forecasts were used to select jobs for inclusion in the job family for which there was an anticipated need nationwide.

**Training Time Requirements.** Jobs were selected for which entry-level training could be completed within a two-year program.

**Training Flexibility.** Jobs were screened in terms of their projected training cost, support requirements, and facilities required.

After this composite picture of the firefighting field had been produced by defining a representative family of jobs, title jobs were selected to represent the job family at the entry, intermediate, and advanced levels of performance. Encompassing the broadest range of skills and knowledge within the job family, the title jobs chosen were: fire cadet (entry level), firefighter (intermediate level), and firefighter supervisor (advanced level).

The next step involved generating a list of tasks and general knowledge concepts to represent the basic skills and knowledge required at the entry level. This step was based on a careful analysis of the D.O.T., U.S. Civil Service Commission Position-Classification standards, employer interviews, and an evaluation of existing inventories of firefighting tasks and general knowledge concepts. The inventories appearing in this guide are the result of this analysis and evaluation.

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* U.S. Department of Labor. Dictionary of Occupational Titles (Vol. 1, Definition of Titles; Vol. 2, Occupational Classification) (3rd ed.). Washington, D.C.: U.S. Government Printing Office, 1965.

In support of the entry-level inventories, task statements were compiled and evaluated at the intermediate and advanced levels. The higher-level task inventories indicate the competencies and knowledge required as the worker progresses up the career ladder. All three task inventories (entry, intermediate, and advanced) are conceived as a core of job performance skills which can be adapted to local educational needs and available school resources.

The final task and general knowledge concept inventories in Sections 1.4 and 1.5 are the bases from which the other sections of the guide were developed: the general job description, the recommended methodology for creating learning activity packages, and the strategies and diagnostic tools available for placing students in the training program.

The methodology used in developing the teaching guide has sêveral important implications for curriculum development efforts. First is the close link established between curriculum intent and instructional practice. If the recommended procedures for developing learning activity packages are followed, the relevance of the instructional content is guaranteed since the occupational analysis produced only the essential, as opposed to the "nice-to-know," tasks and concepts required for acceptable job performance. No matter which tasks and general knowledge concepts the instructor selects from the inventories, the resulting curriculum content relates to the capabilities derived from the occupational analysis.

Second, since the analysis produced many more tasks than a two-year curriculum could logically utilize, the final set of instructional units is determined at the local level by the instructor, who is in the best position to make such decisions. The instructor's selection of tasks and general knowledge concepts from the inventories is made on the basis of identified local employment opportunities, students' needs, and resources available. Consequently, the teaching guide represents a flexible set of materials that can be revised and updated in response to the changing requirements of the career field.

# SECTION 1.3

## General Job Description: Firefighter

The General Job Description provides instructors, career guidance counselors and students with a comprehensive introduction to the career field of firefighting. The information contained in this section* includes an overview of the career field, specific descriptions of the type of work done by the firefighter, places of employment, training requirements, employment forecasts, expected earnings, working conditions, and sources of additional career information.

### NATURE OF THE WORK

Every year fires destroy thousands of lives and property worth millions of dollars. Firefighters help protect the public against this danger. This section of the guide gives information about firefighters who work full-time for city fire departments. It does not cover part-time volunteers, private firefighters, or those employed by the federal and state governments.

During duty hours firefighters must be prepared to rush to a fire and handle any emergency that occurs. Because firefighting is dangerous and complicated, it requires teamwork and good organization. At every fire, firefighters perform specific duties assigned by their commanding officer. They may connect hose lines to hydrants, operate a pressure pump, or position ladders. Because their duties may change several times while the company is in action they must be skilled in many different firefighting activities. In addition, they help people to safety and administer first aid.

Fire departments also are responsible for fire prevention. Many departments provide specially trained personnel to inspect public buildings for conditions that might cause a fire. They may check the number and working condition of fire escapes and fire doors, the storage of flammable materials, and other possible hazards. In addition, firefighters educate the public about fire prevention and safety measures. They frequently speak on this subject before school assemblies and civic groups; and, in some communities, they inspect private homes for fire hazards.

Between alarms, firefighters spend much time improving their skills and doing maintenance work. They also have practice drills, clean and lubricate equipment, and stretch hoses to dry.

### PLACES OF EMPLOYMENT

About 200,000 men worked as firefighters in city fire departments in 1972. Some very large cities have several thousand firefighters; some towns have fewer than 25. In addition, about 1,000 women worked as dispatchers in city fire stations.

### TRAINING, OTHER QUALIFICATIONS, AND ADVANCEMENT

Applicants for firefighting jobs must pass a written intelligence test, a medical examination, and tests of strength, physical stamina, and agility, as specified by local civil service regulations. Applicants must meet certain height and weight requirements and have a high school education. Those who receive the highest scores on the examinations have the best chances for appointment.

In most communities outside the state of Illinois applicants must be at least 21 years of age. In Illinois, several special provisions should be noted: (1) all applicants must be under 35 years of age; (2) persons 16 years of age or older can be appointed to part-time positions within a cadet training program of a municipal fire department (provided that the training program is conducted in conjunction with the Diversified Occupational Program of the local high school district and with the Illinois State Vocational Education System); (3) applicants who are 18 years of age and who have successfully completed two years of study in fire techniques, amounting to a total of four high school credits, within the cadet program of a municipality may be considered for appointment to active duty with the fire department of any municipality; and (4) certain classifications of veterans and persons who have successfully completed two years of study in fire techniques within the cadet program established under the rules of the fire commission of any municipality may receive preference for appointments to offices, positions, and places of employment in the fire department of a municipality.

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*This section has been excerpted from the Occupational Outlook Handbook (1974-75 Edition), U.S. Department of Labor, Bureau of Labor Statistics, Bulletin 1785, and the Illinois Municipal Code, as amended.

As a rule, beginners in large fire departments are trained for several weeks at the city's fire school. Through classroom instruction and practice drills, recruits study firefighting techniques, fire prevention, local building codes, and first aid; also, they learn how to use axes, chemical extinguishers, ladders, and other equipment. After completing this training, they are assigned to local fire companies.

Experienced firefighters often continue study to improve their job performance and prepare for promotional examinations. Fire departments frequently conduct training programs, and many colleges and universities offer courses such as fire engineering and fire science that are helpful to firefighters.

Among the personal qualities firefighters need are mental alertness, courage, mechanical aptitude, endurance, and a sense of public service. Initiative and good judgment are extremely important because firefighters often must make quick decisions in emergency situations. Because members of a crew eat, sleep, and work closely together under conditions of stress and danger, they should be dependable and able to get along well with others in a group. Leadership qualities are assets for officers who must establish and maintain a high degree of discipline and efficiency as well as plan and direct the activities of the firefighters in their companies.

Opportunities for promotion are good in most fire departments. As firefighters gain experience they may advance to higher ratings. After three to five years of service they may become eligible for promotion to the grade of lieutenant. The line of further promotion usually is to captain, then battalion chief, assistant chief, deputy chief, and finally to chief. Chances for advancement generally depend upon each candidate's position on the promotion list, as determined by scores on a written examination, supervisor's rating, and seniority.

## EMPLOYMENT OUTLOOK

The employment of firefighters is expected to increase rapidly through the mid-1980's to meet the need for fire protection in growing urban communities. Many jobs will become available in new and expanding departments; thousands of additional openings will occur as firefighters die, retire, or leave their jobs for other reasons.

Employment of firefighters should continue to grow as new fire departments form and others enlarge their fire prevention sections. Many jobs also will be created as smaller communities replace volunteer fire companies with official departments. In addition, more firefighters will be required as city fire departments continue to shorten the hours that their employees work.

The number of persons who qualify for firefighter jobs in large cities usually is greater than the number of job openings, even though the written examination and physical requirements eliminate many applicants. Therefore, competition among candidates is apt to remain keen.

## EARNINGS AND WORKING CONDITIONS

In 1972, most firefighters in cities with populations of 100,000 or more who had one or two years' experience earned between $9,000 and $10,700 a year.

Salaries varied by city size and region of the country. For example, firefighters earned from $8,100 to $9,700 in small cities, $8,800 to $10,500 in cities of 500,000 to one million in population, and $10,400 to $12,250 in those larger than one million. Earnings for firefighters were lowest in the South and highest in the West. Average earnings of all firefighters were about one and one-half times as much as the average of all nonsupervisory workers in private industry, except farming.

Fire chiefs in cities of 100,000 or more averaged $23,700 a year in 1972. Those who headed fire departments in cities with populations of more than one million earned $32,000.

In Illinois, the state municipal code requires that firefighters be paid not less than $500 per month in municipalities of 5,000–25,000 inhabitants, not less than $550 per month in municipalities of 25,000–50,000 inhabitants, and not less than $600 per month in municipalities of 50,000–250,000 inhabitants.

Practically all fire departments furnish allowances to pay for protective clothing (helmets, boots, and rubber coats) and many also provide dress uniforms.

In some cities, firefighters are on duty for 24 hours, then off for 24 hours, and receive an extra day off at intervals. In other cities, they work a day shift of 10 hours or a night shift of 14; shifts are rotated at frequent intervals. The average workweek for firefighters is 51 hours, but duty hours usually include some time when they are free to read, study, or pursue other personal interests. In addition to scheduled hours, firefighters often must work extra hours when they are bringing a fire under control. When overtime is worked most fire departments give compensatory time off or extra pay.

The job of a firefighter involves risk of death or injury from sudden cave-ins of floors or toppling walls and danger from exposure to flames and smoke. Firefighters also may come in contact with poisonous, flammable, and explosive gases and chemicals. In addition, they frequently work in bad weather.

Firefighters generally are covered by liberal pension plans that often provide retirement at half pay at age 50 after 25 years of service or at any age if disabled in the line of duty. Firefighters also receive paid vacations. Provisions for sick leave usually are liberal. Health and surgical benefit plans are offered in many fire departments and compensation is provided for firefighters injured in the line of duty. Most fire departments provide paid holidays—ranging to 11 or more a year—or compensatory time off for working on holidays.

Nearly three-fourths of all firefighters are members of the International Association of Firefighters (AFL-CIO).

## SOURCES OF ADDITIONAL INFORMATION

Information on obtaining a job as a firefighter is available from local civil service commission offices or fire departments.

Information about a career as a firefighter or specific job duties may be obtained from:

International Association of Firefighters
905 16th Street, N.W.
Washington, D.C. 20006

International Association of Fire Chiefs
1725 K Street, N.W.
Washington, D.C. 20006

Additional information on the salaries and hours of work of firefighters in various cities is published annually by the International City Management Association in its Municipal Yearbook, which is available in many libraries.

A variety of federal agencies have assigned job designation codes to the position of firefighter. These codes are commonly used by federal, state, and local governments. When requesting career information, use these code numbers:

U.S. Civil Service Designation: GS-081

U.S. Department of Labor (D.O.T.) Designation: 373.118 through .884

Standard Industrial Classification Manual Designation: 9224

Office of Education Code: 17.2801

# SECTION 1.4

## Inventory of Job Tasks

This section of the guide presents the lists of tasks, or task inventories, for firefighter work at the entry, intermediate, and advanced levels. These tasks represent the significant learner outcomes of the training program and thus are the core materials upon which curriculum and instructional development efforts can be based.

Preceding each inventory is a brief overview of the title job for the entry level, intermediate level, and advanced level. The letter and number codes preceding each task statement are for identification purposes only. They should not be interpreted as sequential steps or rankings of the tasks by importance. Abbreviations used are: E = entry-level tasks, I = intermediate-level tasks, A = advanced-level tasks.

Section 2.3 provides a qualifications profile of the knowledge, aptitudes, interests, and temperaments required to perform these tasks successfully at the entry level. Sections 2.3 and 2.5 of this guide and the Dictionary of Occupational Titles provide additional information about and detailed explanations of these worker traits.*

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* Worker traits are the abilities, personal traits, and individual characteristics necessary for a worker to achieve average successful job performance.

### ENTRY-LEVEL JOB TITLE: FIREFIGHTER CADET

At the entry level, knowledge and abilities involve the basic ability to learn the methods and techniques of firefighting and the physical abilities necessary to perform strenuous tasks. Entry-level assignments include training intended to develop firefighting skills and knowledge in preparation for the more difficult assignments at higher levels.

Typically, firefighter training assignments include formalized classroom study, on-the-job instruction, and practice drills and demonstrations concerning standard firefighting and rescue procedures and techniques and fire prevention practices. Training includes general theory and methods appropriate to all types of firefighting and specialized procedures and techniques required at the installation. Examples of areas of training are: structural and shipboard fires, aircraft firefighting and rescue, fires involving unusual hazards, and fundamental principles of fire protection.

During the initial stages of training, the firefighter participates in actual firefighting under the immediate supervision of a higher-grade firefighter. As training progresses, the firefighter performs most of the routine tasks with less supervision and assists higher-grade firefighters with more difficult tasks.

At the entry level, the firefighter must have the ability to: (1) perform strenuous physical activities such as lifting heavy firefighting equipment, climbing standard and aerial ladders, and lifting and carrying people and equipment for rescue and salvage; (2) learn to use and maintain firefighting equipment; (3) learn theory necessary for effective firefighting and equipment operation; (4) learn the basic techniques of fighting fires; (5) as appropriate, learn the specialized techniques required for particular hazards involved at the installation to which assigned; and (6) acquire a basic knowledge of first aid.*

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* Excerpted from "Position-Classification Standard for Fire Protection and Prevention Series (GS-081)," U.S. Civil Service Commission, Bureau of Policies and Standards, TS-4, 1971.

## ENTRY-LEVEL TASK STATEMENTS

### Building and Grounds

E-1 Maintain fire station.

E-2 Obtain house supplies.

E-3 Maintain fire station grounds.

E-4 Maintain training facilities.

### Equipment

E-5 Inspect and maintain salvage covers.

E-6 Inspect and maintain hose and couplings.

E-7 Inspect and maintain hydrants, nozzles, and fittings.

E-8 Inspect and maintain holders, clamps, and keepers.

E-9 Inspect and maintain lighting equipment.

E-10 Inspect and maintain tools.

E-11 Inspect and recharge extinguishers.

E-12 Inspect, test, and maintain ropes.

E-13 Inspect, test, and maintain ladders.

E-14 Inspect and replenish first-aid equipment.

E-15 Inspect equipment after runs.

E-16 Inspect, test, and maintain breathing apparatus.

### Driving

E-17 Utilize defensive driving techniques.

E-18 Spot apparatus.

E-19 Protect equipment.

E-20 Use lights and sirens.

E-21 Operate radio equipment.

**Pumps**

E-22 Make suction connection.

E-23 Make discharge connection.

E-24 Operate booster pumps.

E-25 Read and interpret gauges.

E-26 Operate pump from hydrant.

E-27 Operate pump from draft.

E-28 Operate pumps in relay.

**Apparatus**

E-29 Wash, clean, and polish apparatus.

E-30 Inspect and maintain tires.

E-31 Inspect and maintain miscellaneous operating equipment.

E-32 Inspect, maintain, and recharge storage batteries.

E-33 Inspect and maintain warning system.

E-34 Inspect and maintain lighting systems.

E-35 Inspect and maintain hydraulic systems.

E-36 Inspect and maintain power steering.

**Handling Forcible Entry and Miscellaneous Tools**

E-37 Operate carrying tools.

E-38 Operate striking tools.

E-39 Operate battering tools.

E-40 Operate prying tools.

E-41 Operate lighting tools.

E-42 Operate sawing tools.

E-43 Operate boring and drilling tools.

E-44 Operate cutting tools.

E-45 Operate air-moving equipment.

### Lifting and Hoisting Equipment

E-46 Operate lifting tools.

E-47 Operate hoisting and pulling equipment.

### Handling Extinguishers, Generators, and Proportioners

E-48 Operate pressure type extinguisher.

E-49 Operate chemical reaction type extinguisher.

E-50 Operate pump type extinguisher.

E-51 Operate foam generator.

E-52 Operate foam proportioner.

### Handling Hose, Nozzles, and Fittings

E-53 Connect and operate nozzles, valves, and fittings.

E-54 Couple and uncouple hose.

E-55 Extend and reduce lines of hose.

E-56 Siamese lines of hose.

E-57 Roll, fold, carry, reel, and unreel hose.

E-58 Operate hose jackets and clamps.

E-59 Replace damaged section of hose.

E-60 Load hose on carrier.

**Handling Hose**

E-61 Lay single line of hose.

E-62 Lay multiple lines of hose.

E-63 Lay hose lines above street level.

E-64 Connect hose lines to auxiliary appliances.

E-65 Operate batteries, monitors, turret pipes, and ladder pipes.

E-66 Operate water towers.

**Handling Ladders**

E-67 Carry, raise, and lower straight, roof, attic, and extension ladders.

E-68 Climb, lock-in on, and foot ladders.

E-69 Operate aerial ladders and elevated platforms.

E-70 Use ladders as improvised equipment.

**Handling Rescue Equipment**

E-71 Use self-contained breathing apparatus.

E-72 Use detection instruments.

**Making Diagnosis**

E-73 Inspect patient and diagnose symptoms.

E-74 Observe surroundings.

E-75 Determine case history.

**Treating Emergencies**

E-76 Treat burns.

E-77 Treat for heat exhaustion, heat stroke, or excessive cold.

E-78 Treat for fractures, dislocations, strains, and sprains.

E-79 Apply treatment in childbirth emergencies.

E-80 Treat for traumatic, electrical, diabetic, insulin, and emotional shock.

E-81 Treat for convulsions and fits.

E-82 Treat for eye injuries.

E-83 Treat for multiple casualties.

## Controlling Hazards

E-84 Identify fire, lighting, heating, power, and dwelling house hazards and their safeguard.

E-85 Identify commonly found miscellaneous hazards.

## Fire Alarm System

E-86 Receive and transmit box alarms.

E-87 Receive and transmit still alarms.

E-88 Receive and transmit telephone alarms.

E-89 Handle private and business telephone calls.

## Tactics

E-90 Utilize rescue techniques.

E-91 Utilize ventilation methods.

E-92 Utilize method to confine fires.

E-93 Utilize method to extinguish fires.

E-94 Use overhaul methods.

## Fire Investigation

E-95 Identify and preserve evidence.

E-96 Identify the cause of fire.

E-97 Identify data and make proper records.

E-98 Identify values and losses.

E-99 Inspect premises.

E-100 Guard property.

E-101 Prepare evidence for district attorney.

## Special Type Fires

E-102 Extinguish common carrier fires.

E-103 Extinguish brush and grass fires.

E-104 Extinguish fires in places of public assemblage.

E-105 Extinguish fires in hospitals and institutions.

E-106 Extinguish underground fires.

E-107 Extinguish single-story structural fires.

E-108 Extinguish multiple-story structural fires.

E-109 Extinguish basement fires.

E-110 Extinguish petroleum fires.

E-111 Extinguish liquefied petroleum fires.

E-112 Extinguish fires in electrical equipment.

E-113 Extinguish chemical fires.

## Folding and Spreading Salvage Covers

E-114 Fold, carry, spread, and hang covers.

E-115 Use covers as improvised equipment.

E-116 Cover roof openings.

### Protection of Building Contents

E-117 Protect floor and wall coverings.

E-118 Protect furnishings, chattels, machinery, and merchandise.

### Overhauling Premises

E-119 Remove water.

E-120 Remove debris.

E-121 Remove hazards.

E-122 Safeguard property.

### Laws and Regulations

E-123 Interpret and use civil service regulations.

E-124 Interpret retirement, pension, Workman's Compensation Act.

### Personnel Functions

E-125 Identify fire department functions.

E-126 Identify and interpret duties of personnel.

E-127 Identify necessity for study and training.

E-128 Identify necessity for obligation to duty.

E-129 Identify necessity for obedience.

E-130 Develop proper esprit de corps.

E-131 Act as representative of the fire department.

### Pumping and Relaying

E-132 Lift water with pump.

E-133 Determine pump limitations.

E-134 Determine position of engines in relay lines.

**Clerical Functions**

| | |
|---|---|
| E-135 | Operate typewriters. |
| E-136 | Operate office equipment. |
| E-137 | Maintain filing systems. |

## INTERMEDIATE-LEVEL JOB TITLE: FIREFIGHTER

Positions at this level range from nonsupervisory assignments involving structural and/or airfield firefighting requiring the full performance of firefighting tasks of moderate difficulty to those involving more complex, variable, and hazardous performances. By comparison, entry-level assignments are of a trainee nature and are performed under close supervision with detailed instructions.

Intermediate-level firefighters typically provide fire protection for buildings, shops, warehouses, fuel and explosives storage areas, piers, brush and wooded areas, and a variety of other structures and facilities. The knowledge required at this level includes: standard fire protection and prevention theory, techniques and practices relative to various types of structural fires; specialized firefighting techniques for fire hazards peculiar to the installation; use of special safety equipment; basic fire protection inspection techniques; use of special extinguishing agents; techniques and skills in the use of specialized firefighting apparatus; principles of hydraulics as they pertain to water flow, friction, friction loss, etc.; and the mechanics of pumping equipment in order to keep the equipment in working condition and to correct mechanical problems in actual firefighting emergencies.

Given this knowledge, the firefighter at the intermediate level must be able to: work under conditions of heavy physical exertion, extreme heat, smoke and dust, in high and enclosed and smoke-filled spaces, and in all kinds of weather; understand and carry out instructions; maintain order among groups of persons in emergency situations; recall and perform all the functions required in particularly difficult and hazardous firefighting and rescue operations quickly, without hesitation, and with little or no direction from superiors; maintain alertness, self-control, and emotional stability to work under conditions of stress, confusion, panic, and physical injury; adapt standard fire prevention practices and procedures to local requirements; and maintain alertness and skill in detecting and recognizing hazards and evidence of arson and incendiarism.

Some of the typical job titles included in the nonsupervisory, intermediate-level positions are: structural firefighter, airfield firefighter, firefighter, and fire protection inspector. When working with a crew, the firefighter may serve as a hoseman, ladderman, hydrantman, or reserveman.*

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* Excerpted from "Position-Classification Standard for Fire Protection and Prevention Series (GS-081)," U.S. Civil Service Commission, Bureau of Policies and Standards (TS-4), April 1971.

## INTERMEDIATE-LEVEL TASK STATEMENTS

### Equipment

I-1 Make hydrant flow test.

### Treating Emergencies

I-2 Maintain open air passage.

I-3 Perform manual or mechanical resuscitation and cardiac massage.

I-4 Control bleeding and treat wounds.

I-5 Treat for heart malfunction.

I-6 Treat for apoplexy.

I-7 Treat for respiratory, circulatory, or nerve poisons.

### Transporting Patient

I-8 Perform manual lifts and carries.

I-9 Improvise and provide transportation.

### Controlling Hazards

I-10 Utilize fire codes.

I-11 Use standards and publications of N.F.P.A.

I-12 Utilize laws, ordinances, and safety regulations.

I-13 Apply mechanical principle to chimneys and flues in dwellings.

I-14 Apply mechanical principle to types of construction and types of occupancy.

### Making Inspections

I-15 Make exterior and interior surveys.

I-16 Inspect and test auxiliary firefighting equipment.

I-17 Inspect refrigeration, ventilation, and heating systems.

I-18 Inspect electrical appliances and systems.

I-19 Inspect special hazards.

I-20 Inspect storage, handling, and transportation of flammable liquids and gas.

I-21 Inspect storage, handling, and transportation of explosives.

I-22 Make company fire prevention inspections.

**Reporting and Recommending**

I-23 Make required fire prevention reports.

I-24 Maintain fire prevention records.

I-25 Make recommendations for elimination of fire hazards.

**Fire Alarm System**

I-26 Place street box back in service.

**Reports and Records**

I-27 Make required fire alarm reports.

I-28 Fill out fire alarm forms.

I-29 Maintain fire alarm records.

**Strategy**

I-30 Make size-up.

**Tactics**

I-31 Utilize exposure tactics.

I-32 Obtain assistance.

I-33 Place apparatus and equipment.

I-34 Return unneeded apparatus.

### Control of Water

I-35 Operate sprinkler system.

I-36 Operate sprinkler head shut-off and wrenches and restore sprinkler system to service.

### Water Supply

I-37 Determine source and volume of regular supplies.

I-38 Determine source and volume of emergency supplies.

I-39 Determine locations and purpose of control valves.

I-40 Determine service boundaries.

I-41 Determine quantity of water flow through a water main based on diameter, distance, and roughness coefficient.

I-42 Transpose hydraulic gradient into friction loss.

### Arson Investigation

I-43 Identify evidence and types of arson.

I-44 Utilize other law enforcement agencies.

I-45 Identify methods and motives used by arsonists, children, and pyromaniacs.

I-46 Photograph areas.

I-47 Prepare site sketches.

I-48 Recover and label suspicious evidence.

I-49 Guard fire sites.

## Supervisory, Administrative, and Management Functions and Responsibilities

I-50 Do prefire planning.

I-51 Cooperate with other firefighting agencies.

I-52 Use available resources at a fire.

I-53 Determine rescue tactics to be used at a fire.

I-54 Determine methods of casualty handling.

I-55 Locate evidence of incendiarism.

I-56 Locate and protect evidence at a fire.

I-57 Solve fire protection problems involving hazardous materials, e.g., metals, plastics, explosives.

I-58 Size up fire and determine plan of operation.

## ADVANCED-LEVEL JOB TITLE: FIREFIGHTER SUPERVISOR

The advanced-level tasks cover supervisory positions commonly found in fire departments such as fire chief, assistant chief, station chief, and crew chief. Three major variables directly affect the technical difficulty and the degree of responsibility involved in managing a fire department: the prevalence of various types of conditions contributing to the potential for fires; the severity of fires resulting from these conditions if not quickly controlled or extinguished; and the scope of supervisory responsibility as reflected in the size of the fire force necessary to effectively cope with these conditions.

The major fire protection duties and responsibilities involved in supervisory positions include: directing actual firefighting activities; determining requirements and scheduling personnel and equipment for standby duty during hazardous operations; developing firefighting procedures for new and unusual conditions; negotiating mutual aid agreements with other fire departments; and planning for and insuring the adequacy of installed fire suppression and alarm reporting systems.

Administering a fire prevention program includes: continuing contacts with management and employees to "sell" the prevention program; reviewing plans and conducting on-site inspections of new construction and alteration of facilities to insure compliance with fire codes and accepted practices; reviewing reports to determine the adequacy of the program and areas for improvement; and developing and providing training for personnel in fire prevention and fire protection practices.

Other major duties and responsibilities include: supervising the day-to-day operations of the firefighting force; planning and coordinating training, fire prevention, supplies and equipment; and directing crews in fire protection inspection functions.

Workers at the advanced level are responsible, wholly or in part under the direction of higher-level supervisors, for the management and supervision of fire protection and fire prevention programs. They develop, coordinate, and implement programs, policies, regulations, and procedures. They exercise supervisory responsibility for a firefighting and fire protection inspection force ranging in size from four to over 150 employees.*

* Excerpted from "Position-Classification Standard for Fire Protection and Prevention Series (GS-081)," U.S. Civil Service Commission, Bureau of Policies and Standards (TS-4), April 1971.

## ADVANCED-LEVEL TASK STATEMENTS

### Driving

A-1 Utilize department driving rules.

A-2 Drive apparatus.

### Special Type Fires

A-3 Extinguish fires in ammunition dumps.

A-4 Extinguish fires in aircraft.

A-5 Extinguish marine fires.

A-6 Extinguish radioactive material fires.

A-7 Extinguish cryogenic material fires.

A-8 Extinguish pyrophoric material fires.

### Meeting the Public

A-9 Identify the firefighter's public obligations.

A-10 Identify the necessity for good public relations.

A-11 Participate in special details to assemblies.

A-12 Prepare fire department displays.

A-13 Address the public.

A-14 Inform the public of types of service.

### Electricity

A-15 Utilize fundamentals of open and closed circuits.

A-16 Utilize fundamentals of fuses, circuit breakers, lighting arresters, and grounding devices.

A-17 Identify types of wire and cable, sizes, where used, and how determined.

### Related Mechanics

A-18 Interpret N.F.P.A. Handbook of Fire Protection (12th edition) and technical pamphlets.

A-19 Identify mechanical principles of gasoline and diesel motors.

A-20 Identify mechanical principles of ignition.

### Laws and Regulations

A-21 Utilize federal laws.

A-22 Utilize state laws.

A-23 Utilize county ordinances.

A-24 Interpret municipal government organization.

A-25 Interpret city charter.

A-26 Utilize city ordinances.

A-27 Use National Fire Code.

### Training

A-28 Establish or assist in establishing training objectives.

A-29 Prepare or assist in preparing training directives.

A-30 Prepare or assist in preparing training reports.

A-31 Review and evaluate training program effectiveness.

A-32 Monitor training program.

A-33 Prepare or assist in preparing training schedules.

A-34 Review, analyze, and evaluate training test scores.

A-35 Counsel personnel on training progress.

A-36 Publish training schedules.

A-37 Maintain training manual/publication/directive library.

A-38 Obtain and safeguard tests and testing materials.

A-39 Maintain training records and files.

A-40 Attend leadership training.

A-41 Attend safety training.

A-42 Attend first-aid training.

A-43 Plan or assist in planning training programs.

A-44 Organize or assist in organizing training programs.

**Administration**

A-45 Review modern methods of fire prevention and protection through the medium of magazines, books, news letters, records of fires and their causes.

A-46 Estimate situations at fires and issue necessary orders.

A-47 Maintain discipline and respect of subordinates.

A-48 Plan, initiate, and carry out long-range programs in fire department administration.

A-49 Plan, assign, and coordinate activities performed by a large group of employees in varied firefighting work.

A-50 Prepare budgets.

A-51 Propose legislation concerning the fire service.

A-52 Assign personnel.

A-53 Maintain and replace buildings.

A-54 Maintain and replace equipment.

A-55 Install equipment and construct buildings.

A-56 Train personnel.

A-57 Set up program for emergency duty, including mutual aid.

A-58 Set up record-keeping systems in stations and bureaus.

A-59 Oversee budget control.

A-60 Supervise maintenance, expansion, and modernization of fire alarm systems.

A-61 Supervise personnel matters.

A-62 Set up safety programs.

A-63 Determine AIA grading schedule.

A-64 Conduct research in fire science technology.

A-65 Conduct time and motion utilization studies.

A-66 Conduct manpower utilization studies.

A-67 Select personnel.

A-68 Evaluate personnel.

A-69 Analyze records and data.

A-70 Coordinate special local ordinances in fire prevention program.

A-71 Establish basic aims of training.

A-72 Instill discipline through proper training.

A-73 Devise tests to determine a unit's proficiency or progress.

A-74 Establish policies and criteria as a guide for subordinates.

A-75 Minimize administrative burdens at lower echelons.

A-76 Delegate authority to subordinates commensurate with assigned responsibilities.

A-77 Provide necessary means to subordinates to permit accomplishment of assigned mission.

A-78 Establish respect and trust of subordinates.

A-79 Analyze administrative procedures to improve efficiency of operations.

A-80 Conduct periodic review of administrative procedures to determine if desired objectives are being achieved.

A-81 Recruit, interview, and assign personnel.

A-82 Appraise performance and potential of personnel with view toward advancement to positions of greater responsibility.

A-83 Prepare correspondence.

A-84 Execute ordinary business papers, requisitions, purchase orders, and receiving tickets.

A-85 Prepare manuscripts, reports, specifications, requisitions, budgets from predetermined data.

A-86 Provide for guidance and counseling of personnel to further their development.

A-87 Conduct periodic review of procedures and practices in effect in personnel development to determine if desired objectives are being achieved.

A-88 Establish system of job rotation, as applicable in training of personnel, to develop their potential for positions of greater responsibility.

A-89 Maintain executive inventory control to determine if qualified personnel are being trained to meet attritional losses in key positions.

A-90 Know individual characteristics of key personnel and what qualities will elicit their best efforts.

A-91 Establish rating system for evaluation of personnel in duty performance.

A-92 Plan program for promotion.

A-93 Give recognition of outstanding work.

A-94 Establish system of incentives and awards.

A-95 Evaluate or counsel subordinates on work performance.

A-96 Prepare enlisted efficiency reports.

A-97 Recommend personnel for disciplinary action.

A-98 Recommend personnel for promotion or reduction.

A-99 Recommend personnel for reclassification or elimination.

A-100 Recommend personnel for awards and decorations.

A-101 Prepare work schedule.

A-102 Distribute workload.

A-103 Prepare or assist in preparing correspondence and reports.

A-104 Review and route correspondence and reports.

A-105 Process personnel action requests.

A-106 Prepare or assist in preparing firefighting supply.

A-107 Review supply firefighting directives.

A-108 Review and verify firefighting supply requirements.

A-109 Review maintenance directives.

A-110 Prepare or assist in preparing maintenance directives.

A-111 Prepare maintenance requests and work orders.

A-112 Assist in preparing maintenance requests and work orders.

A-113 Requisition firefighting repair parts, tools, and supplies.

A-114 Maintain maintenance request register.

A-115 Maintain firefighting equipment logbook.

A-116 Extract data from firefighting equipment logbook.

A-117 Maintain firefighting equipment locater cards.

A-118 Requisition firefighting maintenance publications.

A-119 Maintain maintenance publications library.

A-120 Prepare equipment inspection list.

A-121 Review and evaluate firefighting equipment inspection list.

A-122 Prepare equipment inspection or maintenance worksheet.

A-123 Review equipment inspection or maintenance worksheet.

A-124 Prepare unsatisfactory firefighting equipment report.

A-125 Prepare equipment improvement recommendations.

A-126 Review and verify equipment serviceability criteria.

A-127 Prepare or review equipment modification records.

A-128 Prepare or review material readiness report.

A-129 Prepare or review equipment utilization records.

A-130 Prepare or review preventive maintenance schedule.

A-131 Annotate post-firefighting maintenance records.

A-132 Prepare firefighting maintenance reports.

A-133 Maintain maintenance records, reports, and files.

A-134 Select or assist in selecting generator set worksites.

A-135 Inspect generator set for damage or serviceability.

## Personnel Supervision and Management

A-136 Instruct personnel in firefighting procedures.

A-137 Supervise personnel conducting firefighting operations.

A-138 Determine water supply requirements.

A-139 Determine handtool requirements.

A-140 Select firefighting equipment.

A-141 Prepare personnel duty assignments.

A-142 Conduct firefighting equipment and supply inventories.

A-143 Plan stock level maintenance procedures.

A-144 Prepare and conduct briefings to superiors.

A-145 Prepare work schedules.

A-146 Prepare organizational charts.

A-147 Prepare and maintain training timetable charts.

A-148 Instruct personnel in appraisal/preparation procedures.

A-149 Supervise personnel conducting appraisal/preparation operations.

A-150 Instruct personnel in fire control/extinguishing operations.

A-151 Supervise personnel conducting fire control operations.

A-152 Supervise personnel conducting fire extinguishing operations.

A-153 Direct personnel and animal rescue operations.

A-154 Control personnel and animal rescue operations.

A-155 Instruct personnel in rescue procedures.

A-156 Supervise personnel conducting rescue operations.

A-157 Instruct personnel in first-aid procedures.

A-158 Supervise personnel conducting first-aid operations.

A-159 Instruct personnel in property salvage procedures.

A-160 Supervise personnel conducting property salvage operations.

A-161 Determine extent of property damage.

A-162 Determine property salvage requirements.

A-163 Estimate standing water weight.

A-164 Instruct personnel in post-firefighting procedures.

A-165 Supervise personnel conducting post-firefighting operations.

A-166 Instruct personnel in fire investigation procedures.

A-167 Supervise personnel conducting fire investigation operations.

A-168 Check areas for causative evidence.

A-169 Question witnesses.

A-170 Check and record condition of area contents.

A-171 Check and record nature of burning materials.

A-172 Check and record window and door locations.

A-173 Check and record alarm types.

A-174 Check and record wind direction.

A-175 Check and record weather conditions.

A-176 Prepare initial investigation reports.

A-177 Determine and record origin of fires.

A-178 Determine and record cause of fires.

A-179 Determine and record extent of damage.

A-180 Inventory undamaged items.

A-181 Compare post-fire inventories with previous inventories.

A-182 Estimate monetary losses.

A-183 Prepare and forward fire reports.

A-184 Monitor vehicle and equipment maintenance operations.

A-185 Instruct personnel in vehicle and equipment maintenance.

A-186 Supervise personnel conducting vehicle and equipment maintenance.

A-187 Instruct personnel in fire prevention and inspection operations.

A-188 Supervise personnel conducting fire prevention inspection.

A-189 Schedule fire prevention inspections.

A-190 Prepare and maintain fire prevention publication libraries.

A-191 Prepare or assist in preparing job descriptions.

A-192 Prepare or assist in preparing firefighting standard operating procedures.

A-193 Conduct or assist in conducting inspections.

A-194 Direct/control firefighting planning operations.

A-195 Determine personnel requirements.

A-196 Determine firefighting equipment requirements.

A-197 Determine fire protection system requirements.

A-198 Determine firefighting equipment maintenance requirements.

A-199 Plan budget estimates.

A-200 Prepare joint communication plans.

A-201 Prepare safety and fire prevention plans.

A-202 Prepare fire control and extinguishing plans.

A-203 Plan security programs.

A-204 Plan firefighting equipment modifications.

A-205 Plan area fire marshal programs.

A-206 Prepare unit emergency and disaster plans.

A-207 Plan firefighting improvement techniques.

A-208 Plan firefighting publication changes.

A-209 Direct firefighting appraisal and preparation operations.

A-210 Control firefighting appraisal and preparation operations.

A-211 Assign vehicle positions.

A-212 Assign fire crew tasks.

A-213 Position vehicles at fire sites.

A-214 Direct fire control and extinguishing operations.

A-215 Control fire control and extinguishing operations.

A-216 Direct first-aid operations.

A-217 Direct property salvage operations.

A-218 Direct post-firefighting operations.

A-219 Direct fire investigation operations.

A-220 Direct fire prevention inspection operations.

A-221 Operate elevators.

A-222 Operate fire doors and shutters.

A-223 Use life net.

A-224 Use life gun, lines, and belts.

# SECTION 1.5

## Inventory of General Knowledge Concepts

This section of the guide presents the list of general knowledge concepts which support the performance of tasks at the entry level. General knowledge concepts refer to the important background knowledge required of firefighters. They form the academic grounding for effective performance of the job tasks. Many of the concepts relate to topics that may be taught in academic courses such as chemistry, physics, mathematics, and health. They can be used in conjunction with the tasks to develop learning activity packages (see Section 1.6).

The numbers preceding each of the concepts are for identification purposes only; they should not be interpreted as sequential steps or rankings. The concepts are categorized by broad topical areas. Under each category are suggestions for teaching the particular group of concepts.

### GENERAL KNOWLEDGE CONCEPTS

**Program Orientation**

1 Provide an orientation to the program of study.

Teaching Suggestions: Emphasize adherence to the break schedule and duty hours. Give appropriate information and phone numbers to use in case of emergency. Outline and discuss policies and procedures of the training program. Stress the importance of personal appearance. Demonstrations should include a walk-through of the facilities; stress energy and materials conservation.

**Fire Protection Mission and Organization**

2 Without reference, select the fire protection mission with 80 percent accuracy.

3 Without reference, identify basic facts concerning the fire protection organizational structure with 80 percent accuracy.

4 Without reference, identify basic facts concerning the progression in the firefighting career ladder with 80 percent accuracy.

5 Without reference, identify basic facts and principles concerning the duties and responsibilities of the fire cadet with 80 percent accuracy.

Teaching Suggestions: Stress the importance of knowledge about the internal structure and jobs performed in the fire prevention and protection institution.

### Fire Protection Occupational Safety

6 Without reference, identify safe and unsafe procedures for the wearing of protective clothing with 80 percent accuracy.

7 Without reference, identify safe and unsafe procedures for fighting fires with 80 percent accuracy.

> Teaching Suggestions: Relate the subject to the fire protection career field. Safety during all phases of fire protection operations must be observed due to extreme hazards which may be encountered. Cover noise hazards associated with the fire protection career field.

### Principles and Theory of Combustion

8 Without reference, identify characteristics and hazards of flammable materials with 80 percent accuracy.

> Teaching Suggestions: Safety procedures during all phases of demonstration should be stressed. The point should also be made that all demonstrations are simulations of actual situations which can and will occur in the field. Keep students at a safe distance from the demonstration. Inform the class that designated individuals will assist the instructor should assistance be needed in an emergency.

### Extinguishing Agents

9 Without reference, identify principles relating to suppression, control and extinguishment of fires with 80 percent accuracy.

10 Without reference, identify the characteristics of extinguishing agents by matching proper agents to classes of fires and associated hazards with 80 percent accuracy.

> Teaching Suggestions: Stress safety in the use of $CO_2$ in confined areas and water on electrical fires. Insure that the laboratory equipment and training equipment used are properly cleaned up after the demonstration. Notify the appropriate supervisor when samples of extinguishing agents run low.

### Introduction to First Aid

11 Given a victim identified as having been in an accident, identify procedures for checking victim for injuries. Procedures must be in accordance with the American National Red Cross First Aid Manual

and Emergency Care.

Teaching Suggestions: Stress the importance of knowing how to administer emergency first aid. Allow students to identify simulated victims requiring first aid treatment. Use the casualty kit to simulate victims.

## Identification and Treatment of Shock

12 Given a victim identified as being in shock, identify procedures to prevent or reduce shock. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and Emergency Care.

Teaching Suggestions: Use the casualty kit to assist in simulating a victim requiring treatment of shock. Use the emergency first aid equipment as required.

## Swallowed Objects and Choking

13 Without reference, identify procedures for administering emergency first aid treatment for swallowed objects and choking with 80 percent accuracy.

Teaching Suggestions: Stress the importance of being able to identify a victim suffering from swallowed objects and choking and the treatment required.

## Poisoning and Drugs

14 Without reference, identify procedures for administering emergency first aid for poisoning with 80 percent accuracy.

15 Without reference, identify procedures for emergency first aid treatment for drugs with 80 percent accuracy.

Teaching Suggestions: Stress the importance of identifying correctly either drug overdosage or poisoning of a victim. Stress the importance of proper treatment of the victim to preclude further complications.

### Identification and Treatment of Wounds

16 Given a victim identified as having a wound, identify procedures for the prevention of contamination and the control of bleeding. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and Emergency Care.

> Teaching Suggestions: Stress identification and treatment of different types of wounds. Use the casualty kit and first aid equipment as required.

### Identification and Treatment of Specific Injuries

17 Without reference, identify procedures for administering emergency first aid for burns with 80 percent accuracy.

18 Without reference, identify procedures for administering emergency first aid for frostbite and cold exposure with 80 percent accuracy.

19 Without reference, identify procedures for administering emergency first aid treatment for heat stroke, heat cramps, and heat exhaustion with 80 percent accuracy.

> Teaching Suggestions: Stress identification and treatment of the three classes of burns, injuries from cold or heat exposure. Use the casualty kit and first aid equipment as required.

### Dressing, Bandaging and Splinting

20 Given a victim identified as needing a dressing or bandage, identify procedures for applying a dressing or bandage. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual.

21 Given a victim identified as needing a tourniquet, identify procedures for applying a tourniquet. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and Emergency Care.

22 Given first aid equipment and a victim identified as having a fracture, identify procedures for administering first aid for fractures. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and Emergency Care.

> Teaching Suggestions: Stress the importance of using correct methods in dressing or bandaging a wound. Stress that first aid consists of just splinting the fracture in place until a doctor can set the fracture. Use the casualty kit as required.

## Sudden Illness

23 Without reference, identify procedures for administering emergency first aid for sudden illnesses with 80 percent accuracy.

Teaching Suggestions: Stress the importance of correct identification in cases of sudden illnesses and the importance of proper first aid procedures.

## Respiratory Emergencies and Artificial Respiration

24 Given a resuscitation manikin, identify procedures for administering artificial respiration. Procedures utilized must be in accordance with the American National Red Cross First Aid Manual and Emergency Care.

25 Given a resuscitation manikin, workbook and resuscitation device, identify inhalation procedures.

26 Given a resuscitation manikin, workbook and resuscitation device, identify aspiration procedures.

Teaching Suggestions: Stress correct first aid procedures for the treatment of respiratory arrest.

## Cardiopulmonary Resuscitation

27 Given a resuscitation manikin, identify procedures for administering cardiopulmonary resuscitation. Procedures must be in accordance with the American Heart Association.

Teaching Suggestions: Stress the correct first aid procedures for the treatment of cardiac arrest.

## Prefire Plans

28 Without reference, identify basic facts concerning preparation of prefire plans with 80 percent accuracy.

Teaching Suggestions: Stress the importance of prefire planning in the fire service and how it supports the mission of fire protection.

### Rescue Procedures

29 Without reference, identify procedures for rescuing personnel from miscellaneous areas and disasters with 80 percent accuracy.

Teaching Suggestions: Stress the importance of knowledge of the rescue procedures used in different situations.

### Emergency Response Activities

30 Without reference, identify safe and unsafe procedures concerning emergency response activities with 80 percent accuracy.

Teaching Suggestions: Stress the need for arriving at the fire scene safely in order to perform the primary job of saving lives and protecting property from fire. Stress that when responding to emergencies the red light and siren merely ask for the right of way, they do not give it.

### Alarm Room Procedures and Operation

31 Without reference, identify operational procedures of the alarm and communication center with 80 percent accuracy.

Teaching Suggestions: Stress the importance of remaining calm and accurate in recording information. Never discuss personal information over the communication system.

### Inspection and Maintenance of Mounted Equipment and Operations on Structural Pumpers

32 Given the appropriate form and technical data, identify operator maintenance procedures for a structural firefighting vehicle and mounted equipment.

33 Given a structural firefighting vehicle and mounted equipment, identify booster operation procedures in accordance with technical order procedures.

Teaching Suggestions: Stress safety during pump operations, to include watching for loose or nozzleless lines, excessive pressure, proper vehicle and pump operation, and insure that chocks are in place. When pumping on the station floor, insure that the exhaust pipes are connected to the pumpers. Remind students of the dangers involved while performing on a vehicle with the engine running. Stress that the other doors in the station are to be kept closed to reduce the noise level. Report any damaged exhaust system problems to your supervisor immediately. Stress the importance of properly operating fire service equipment in order to prevent damage resulting in costly repairs. Stress energy and conservation of materials.

## Pumping Operations on Structural Pumpers

34 Given a structural firefighting vehicle and mounted equipment, identify hydrant operations in accordance with technical order procedures.

35 Given a structural firefighting vehicle and mounted equipment, identify drafting operations in accordance with technical order procedures.

36 Given a structural firefighting vehicle and mounted equipment, identify foam pumping operations in accordance with technical order procedures.

Teaching Suggestions: Stress safety during pump operations, to include watching for loose or nozzleless lines, excessive pressure, proper vehicle and pump operation, and insure chocks are in place. When pumping insure that the station exhaust pipes are connected to the pumpers. Remind the students of the dangers involved while performing on a vehicle with the engine running.

## Vehicle Positioning, Relay and Hose Operations

37 Without reference, identify the correct procedures for positioning firefighting vehicles with 80 percent accuracy.

38 Without reference, identify the proper procedures for vehicle relay operations with 80 percent accuracy.

39 Without reference, identify the correct procedures for hose operations with 80 percent accuracy.

Teaching Suggestions: Stress the importance of positioning the vehicle so that it can be used most advantageously. Explain why a relay operation may be necessary and why efficient hose operations are essential to combat fires.

## Structural Firefighting Procedures

40 Without reference, identify principles of structural firefighting with 80 percent accuracy.

41 Without reference, identify the principles of building heat and smoke ventilation with 80 percent accuracy.

42 Without reference, identify visual inspection procedures for determining structural stability of a building with 80 percent accuracy.

Teaching Suggestions: Emphasize how all aspects of structural firefighting procedures are interrelated. Stress the importance of the visual inspection for structural stability to prevent firefighting crews from being hurt.

## Structural Firefighting Tactics

43 Given a building, identify normal and emergency entry procedures. All applicable safety procedures must be strictly adhered to.

44 Given a building and appropriate cleanup equipment, identify firefighting overhaul cleanup operations.

Teaching Suggestions: Stress the importance of using equipment according to safe practices.

## Preservation of Evidence

45 Without reference, identify procedures for preserving evidence to determine cause of a fire with 80 percent accuracy.

Teaching Suggestions: Stress the importance of preserving evidence at a fire scene to help in determining the cause of the fire and how to protect the evidence from being tampered with.

## Fire Protection Hydraulics

46 Without reference, identify principles of hydraulics as they apply to fire protection with 80 percent accuracy.

47 Identify and define symbols and signs.

48 Interpret formulas.

49 Determine area, volume, and capacity.

50 Determine pressure when head is known.

51 Determine head when pressure is known.

52 Determine weight of water and its effect on structure and contents.

53 Identify sprinkler systems' benefits and limitations.

54 Determine velocity when head, pressure, or flow is known.

55 Determine flow when velocity is known.

56 Determine velocity of flow in one carrier when the velocity of flow in another carrier is known.

57 Determine water hammer cause and effect.

58 Determine friction loss in hose.

59 Determine flow when friction loss is known.

60 Determine friction factors.

61 Determine friction loss in hydrants, pipe, and water main.

62 Determine friction loss in standpipes and sprinkler systems and other applications.

63 Utilize principles of hydraulics in testing pumps.

64 Identify fundamentals of pressure, vacuum, flow, head, suction, displacement, friction loss, back pressure, hydrant pressure, engine pressure, nozzle pressure, and capacity.

65 Interpret effect of adverse conditions on pumps such as dry operation, salt water, and water temperature.

66 Interpret proper selection of pumps relative to discharge.

67 Determine R.P.M. of motor and pump and their relation to discharge.

68 Identify the characteristics of piston type, centrifugal, and rotary gear pumps, and the proper application of each.

69 Identify single-stage or multi-stage series and parallel pumps. Recognize the restricted use of certain types of pumps.

70 Recognize the particular care required of piston type pumps.

71 Use churn valves and relief valves.

72 Use priming devices for different pumps.

73 Determine engine or nozzle pressure.

74 Determine EP by mental calculation.

75 Determine diameter of nozzle equalent.

76 Determine K factors.

77 Determine discharge when pressure is known.

78 Determine diameter of nozzle when discharge and pressure are known.

79 Determine discharge from sprinkler system.

80 Determine coefficient for discharge.

81 Determine pump discharge at various pressures.

82 Determine horizontal and vertical range.

83 Determine NP for horizontal and vertical range.

84 Determine safe working pressures as related to nozzle size.

85 Determine one side of right triangle.

86 Determine angle of penetration.

87 Determine width of bracing necessary for given nozzle reaction.

Teaching Suggestions: Stress importance of hydraulics in fire service to provide proper and safe streams and to prevent damage to pump and associated equipment.

## Related Chemistry

88 Identify theory and fundamentals of combustion.

89 Identify cause and effect of improper combustion.

90 Identify common volatile oils.

91 Identify common gases encountered at fires.

92 Identify exotic fuels.

93 Interpret action of different extinguishing agents on various types of fires.

94 Interpret spontaneous ignition.

95 Identify hazards of dust explosion.

96 Identify the effect of water on fires involving chemicals, steel, concrete, brick, heavy timber and copper structures, dust-producing products, and volatile oils of various flash points.

97 Identify the effect of fire on steel, concrete, brick, heavy timber, and frame construction.

98 Identify the effect of fire on various commodities, such as baled cotton, jute, oil (in drums), paints, lime, and exotic fuels.

Teaching Suggestions: Stress the importance of these chemical concepts in firefighting. Use practical examples to teach these concepts.

## Related Mathematics

99 Perform addition, subtraction, multiplication, and division.

100 Obtain powers of numbers.

101 Extract square root.

102 Use simple proportion.

103 Use simple algebraic equations.

Teaching Suggestions: Stress the importance of these mathematical operations in firefighting. Use practical examples to teach these operations.

# SECTION 1.6
# How to Develop Learning Activity Packages

The development of a performance-based curriculum for fire cadet training is based on a method called functional job analysis (described in Section 1.2). This method of analyzing actual job requirements as defined by employers is an effective way to develop a training curriculum. With this method, a training program curriculum contains the essential skills and knowledge that an entry-level worker performs on the job and leads to the development of an instructional system that describes **what, why,** and **how** the trainee is to learn these skills and knowledge.

This section explains how to take the tasks and general knowledge concepts presented in Sections 1.4 and 1.5 and develop units of instruction, or learning activity packages (LAPs), from them. Two sample LAPs—one based on a task and one based on a general knowledge concept—are included as models that can be used to develop LAPs at the local level.

In addition to the information and sample LAPs presented here, which are specifically related to the fire cadet training program, the instructor should refer to the series of POP (Pre-Service Occupational Program) Kits available from the Illinois Office of Education. The POP Kits cover such instructional planning topics as student performance objectives, domains of learning, writing sets of objectives, lesson planning, unit planning, constructing learning activity packages, and instructional materials.

Section 1.6, when used in conjunction with the POP Kits, provides the tools for building an instructional system based on the tasks, general knowledge concepts, and supplementary materials presented in this guide.

## PRINCIPLES OF LEARNING

No matter what the content of a curriculum or the instructional methods used, there are several basic principles of learning that underlie the development of learning activity packages. The two sample LAPs presented later in this section are guided by these principles; it is strongly recommended that the seven principles of learning described below be kept in mind as LAPs are developed for the training program.

**Optimum Step Size.** Optimum step size involves the application of two concepts. First, students learn best when they are not frustrated by material that is too difficult. Second, students learn best when they are challenged beyond boredom. To apply these concepts, instruction is developed by increments, or steps, that are small enough to permit mastery without frustration but are large enough to provide meaningful challenge. Determining the optimum step size depends on several factors such as student background, intelligence, difficulty of material, and so on.

**Controlled Responding.** Not only is the instruction presented to the student in predetermined steps, but it also directs him or her to assume an active role by performing specific activities within each step. These activities are determined during the development of the learning activity package. It requires each student to apply what he or she learns as it is learned. This insures that the student progresses toward the learning objective. When controlled responding is built into the learning, the student becomes an active, rather than passive, participant in the learning experience.

**Knowledge of Results.** After responding overtly to each optimum step of instruction, the student learns whether the response was correct or incorrect. Such knowledge of results, also known as confirmation, serves two purposes. Its primary purpose is to reinforce the learning process. When a student responds correctly and is told so, the learning of correct performance is reinforced and he or she is motivated toward further learning. Its secondary purpose is to correct wrong responses and thus prevent the student from practicing wrong performances. Without such timely knowledge of results, a student can repeat a mistake until it becomes part of his or her performance.

**Controlled Pacing.** In conventional instruction the training time is usually a constant factor. For example, if it has been decided that a specified amount of time will be spent on a segment of learning, then all students receive the specified amount of time regardless of differences in aptitude. We know from experience, however, that students learn at varying rates; but little provision is ever made for this obvious fact. By using LAPs, on the other hand, instruction time becomes a variable instead of a constant factor. If student self-pacing can be built into the learning situation, each student is allowed to progress at his or her own rate according to learning ability. If self-pacing is working effectively, the faster student is not held back and the slower student is not forced to rush in order to keep up. Controlled pacing confirms the learning activity package as the method that most practically achieves a balance between the needs of teaching and the requirements of learning. If individually paced learning is not practicable, then a group-paced approach can be used. In this approach, students are organized into homogeneous pacing groups so that each group can proceed at the appropriate learning rate.

**Validation.** Validation is the process of determining the effectiveness of instruction. It places the burden of teaching upon the system; if the students fail to achieve the objective of the learning activity package, one should assume that the instruction has failed. When such failure occurs, the instruction should be revised and restructured until the students achieve the learning objective.

**Student-Centered Approach.** The student-centered approach is one that incorporates all the previous principles in a comprehensive learning system. The final outcome of instruction is focused on student performance and measuring that performance. Learning is student-centered when the student has been taught through optimum steps, has been directed to respond, has been provided with knowledge of results, has progressed at his or her own rate, or within a rate appropriate to a particular homogeneous group, and when a careful analysis of the student's performance has been conducted.

**Performance Analysis.** The final product of a performance analysis includes: a complete, precise listing of the skills and knowledge that must be taught in order to prepare the student to master the objective; a determination of the conditions under which the student will perform; and the factors which constitute acceptable performance by the student. Performance analysis consists of a review of all performance objectives, field surveys, task observations, and any other process which yields empirical data about the actual performance the student is expected to demonstrate at the conclusion of a learning activity package. The analysis should involve only those skills and knowledge that are critical to performance of the task or achieving the objective. It should omit any material that is "nice-to-know," but not critical.

## LEARNING ACTIVITY PACKAGES

The successful learning activity package is based on the comprehension, by the instructor and the student, of these four terms: objective, overview, learning experience, and summary.

The **objective** is the end result toward which student effort is directed in the package. It is stated in performance terms, which means that the student must demonstrate achievement of the performance specified. The objective states what the student should have learned at the completion of the LAP. The **overview** explains why it is important to achieve the stated objective and how it can benefit the student. The

**learning experience** guides the student through a step-by-step process to achieve the objective. The **summary** reviews the reason for doing the particular activity and reinforces the learning that has occurred during the LAP.

The key point of a learning activity package is, of course, the LAP's objective. The objective determines both the content and the activities of the LAP. The other components of the LAP, particularly the learning experiences, should support and satisfy the learning objective. Upon completion of the activities prescribed by the learning experiences, the student should be able to demonstrate the capability stated in the objective.

The learning experiences within the LAP should reflect the student capabilities necessary to satisfy the LAP's objective. The number of experiences and their content may vary from LAP to LAP. In fact, a given capability can, and should, be attained through different kinds of learning experiences. The instructor should be able to use various types of instructional methods (see Section 1.7) in order to provide students with appropriate learning experiences that will lead to mastery of the LAP objective.

In order to provide the student with first-hand exposure to vocational capabilities, emphasis must be placed on performance-based learning experiences—i.e., LAPs based on the tasks presented in Section 1.4. These experiences are augmented by experiences which provide a theoretical and conceptual framework around which the tasks are based—i.e., the general knowledge concepts provided in Section 1.5.

Performance-based activities permit the student to utilize both cognitive and psychomotor processes in achieving the objectives of a learning activity package. They also provide the instructor and student with the opportunity to evaluate the attainment of vocational capabilities.

Non-performance activities, to be sure, have their value; but these activities alone cannot provide the student with the capabilities which he or she will need on the job in the working world. In addition, many students are at relatively low reading and vocabulary levels; this casts doubt on how much the student really learns through these methods. There is also a question if portions of theories, principles, or concepts are really needed by the student to achieve given capabilities at a particular level or if they are needed at all. Determining how much theory and how much practice is to be included in a learning activity package is sometimes a difficult process. Very often, however, a clear statement of the LAP's objective will provide the answer.

Another factor to be considered in developing LAPs involves the selection of appropriate reference materials and teaching-learning aids. This requires a consideration of a number of factors, such as the relevance of the information, the ability of the student to benefit from it, and its availability, cost, and ease of use. These must be evaluated continually since the criteria for their selection may change from LAP to LAP. Section 1.8 lists reference materials and teaching aids which the instructor should find useful in developing learning activity packages.

## DEVELOPING LAPS FROM A TASK

In Section 1.1 of the guide you followed a series of steps in order to specify the content of the training program. The result of this process was a sequenced list of performance-based tasks supported by general knowledge concepts. The steps below show one way to identify the skills, knowledge, and activities related to each task that can be used to develop one or more learning activity packages.

To help you work through these steps, three worksheets are provided on the following pages. (Blank worksheets are provided at the end of this section for duplication and use by the instructor.) Steps 1-6 explain Worksheets 1 and 2 and help you to gather and organize the information needed to develop a LAP. Worksheet 1, "Task Listing," involves selecting a task for instruction and identifying tasks that are related to the selected task. Worksheet 2, "Task Analysis," is used for breaking down a task into the skills and knowledges required to perform the task. Steps 7-11 explain Worksheet 3, "LAP Outline," which is used for organizing the information developed on Worksheets 1 and 2 into a learning activity package outline.

**STEP 1: Select a task for instruction.**

From your list of sequenced tasks, select one task for instruction. Write this task down in the space provided on Worksheet 1. For the sample LAP presented in this section, the following task was selected: "Use overhaul methods."

**STEP 2: Identify tasks that are closely related to the task selected in Step 1.**

Although you are working with only one task at a time, it is important to identify those tasks that are closely related to the task you selected. By completing this step, you will establish interrelationships among a group of tasks. Write down these tasks in the spaces provided on Worksheet 1. Examine these tasks and how they are related to one another. This helps to establish a sequence for other learning activity packages that you will develop.

**STEP 3: Specify the learning conditions and outcomes of the task to be performed by the student.**

Moving on to Worksheet 2, write down the task, the learning conditions under which the task will be performed by the student, and the outcomes which will be used to evaluate student performance. For the sample LAP, the learning conditions are: "Simulation of actual overhaul operations." The criterion for judging student performance are: "The student will conduct overhaul activities under supervision."

**STEP 4: Break down the task into learning activities.**

The task you have selected should now be broken down into more manageable components—learning activities. List these activities in the spaces provided on Worksheet 2.

**STEP 5: Break down each activity into specific steps.**

On Worksheet 2 each activity has been broken down into a series of steps. For example, under the activity of "Analyze the cause of the fire," five steps have been listed:

Step 1. Obtain occupant's opinion of how fire started.
Step 2. Locate point of origin.
Step 3. Obtain occupant's description of all materials at the point of origin.
Step 4. Gather information from firefighters, citizens, and neighbors.
Step 5. Conduct personal study of fuel and heat sources at point of origin.

For each of the other three activities specified above, a similar sequenced list of steps has been generated on Worksheet 2.

**STEP 6: Identify the knowledges which support the performance of each activity.**

The final component of Worksheet 2 is a listing of the knowledges which support the performance of the steps under each activity. For example, in analyzing the cause of the fire it is important for the fire cadet to have a knowledge of the variety of causes of fires. The supporting knowledges are listed below the series of steps for each activity identified on Worksheet 2.

Steps 1-6 above have helped you to gather and organize the information needed for the development of LAPs related to a single task statement: "Use overhaul methods." All of this information has been entered on Worksheets 1 and 2. Steps 7-11 explain how to take the information from Worksheets 1 and 2 and develop an outline for a single learning activity package.

**STEP 7: Select one learning activity from Worksheet 2 as the content for a single LAP.**

In the sample provided in this section, the learning activity "Analyze the cause of the fire" has been selected as the content for a learning activity package. The other three learning activities identified can be used for the development of subsequent LAPs. The intent of selecting just one learning activity is to narrow the focus of instruction into manageable units. Enter the activity name and the steps into which it has been broken down in the spaces provided on Worksheet 3.

**STEP 8: Write the objective for the LAP.**

On Worksheet 2 the learning conditions and the performance criteria were identified for the task statement as a whole. Using this information as a foundation, write the LAP objective as it pertains to the specific learning activity you selected. Remember that the objective is a statement of what the student will be able to do at the completion of the LAP. On Worksheet 3 the objective of the sample LAP has been stated as: "In a simulated overhaul operation, the student will analyze the cause of a given fire."

**STEP 9: Write an overview to the LAP.**

The overview provides a general introduction to the LAP, explains the importance of the LAP's objective, and how it can benefit the student. It also serves as a link to other kinds of tasks that have already been taught or will be taught in subsequent LAPs (see Worksheet 1). Writing the overview is an important step in LAP development, because it requires the instructor to focus his or her attention on what is to be learned during this particular LAP. Review the sample overview on Worksheet 3 to see how this is accomplished.

**STEP 10: List learning experiences for the LAP.**

Learning experiences should take into account all of the steps listed at the top of Worksheet 3. In preparing a LAP outline, list the learning experiences that are needed to deal with each step and that will accomplish the objective. For the sample unit these are listed in the space provided under "Learning Experiences."

**STEP 11: Write a summary of the LAP.**

The summary provides a review of the outcome of the learning experiences in order to reinforce the learning that has taken place during the LAP. Space is provided on Worksheet 3 to write this summary.

## Worksheet 1

## TASK LISTING

**Job:** Firefighter Cadet

**Task:** Use overhaul methods.

**Related Tasks:**

1. Identify the cause of the fire.
2. Remove hazards.
3. Safeguard property.
4. Identify evidence and types of arson.
5. Remove water.
6. Remove debris.
7. Identify data and make proper records.
8. Inspect premises.
9. Operate draining devices.
10. Identify the cause of fire.

## Worksheet 2

## TASK ANALYSIS

**Job:** Firefighter Cadet

**Task:** Use overhaul methods.

**Learning Conditions:** Simulation of actual overhaul operations.

**Outcome:** The student will conduct overhaul activities under supervision.

**Learning Activity:** Analyze the cause of the fire.

**Steps:**

1. Obtain occupant's opinion of how fire started.
2. Locate point of origin.
3. Obtain occupant's description of all materials at the point of origin.
4. Gather information from firefighters, citizens, and neighbors.
5. Conduct personal study of fuel and heat sources at point of origin.

**Supporting Knowledge Required:** knowledge of basic causes of fire

## TASK ANALYSIS

**Learning Activity:** Eliminate hazards.

**Steps:**
1. Check for weakened chimneys.
2. Check overhanging cornices.
3. Check for weakened walls.
4. Check for insecure timbers.
5. Sweep up broken glass.

**Supporting Knowledge Required:** understanding of the definition and purpose of overhaul

Worksheet 2 – Continued

TASK ANALYSIS

Learning Activity: Observe general conditions at the scene of the fire.

Steps:

1. Observe the elements.
2. Observe persons and automobiles.
3. Observe color of smoke and flame.
4. Observe size of fire and speed at which it is traveling.
5.

Supporting Knowledge Required: knowledge of special types of fire

## TASK ANALYSIS

**Learning Activity:** Look for indications of arson intent.

**Steps:**

1. Look for multiple fires.
2. Look for uneven wood burning.
3. Look for inoperative sprinklers and fire doors.
4. Look for containers used for flammable liquids.
5. Look for residues of wax or paraffin.

**Supporting Knowledge Required:** knowledge of arson methods, materials, and equipment

Worksheet 3

## LEARNING ACTIVITY PACKAGE OUTLINE

**Job:** Firefighter Cadet

**Task:** Use overhaul methods.

**Learning Activity:** Analyze the cause of the fire.

**Steps:**
1. Obtain occupant's opinion of how fire started.
2. Locate point of origin.
3. Obtain occupant's description of all materials at the point of origin.
4. Gather information from firefighters, citizens, and neighbors.
5. Conduct personal study of fuel and heat sources at point of origin.

**Supporting Knowledge Required:** knowledge of basic causes of fire

**Worksheet 3 — Continued**

## LEARNING ACTIVITY PACKAGE OUTLINE

**LAP Objective:** In a simulated overhaul operation, the student will analyze the cause of a given fire.

**Overview:** When the cause of a fire is being determined, both the fuel and the heat sources that caused ignition must be considered. Fires do not start without a cause, and the cause is always present. Fire department personnel should judge fuel hazards and heat hazards by their characteristics. Remember, a fire is caused only when fuel and heat come together and both the fuel and heat that started the fire should be entered into the records as the fire cause.

**Learning Experiences:**

1. Student-instructor conference to set up simulation exercise.
2. A film on proper overhaul technique when analyzing the cause of a fire.
3. Background readings on related aspects of analysis; problem areas; correct procedure; etc.
4. Video-tape recording of overhaul techniques.
5. Other teaching-learning approaches deemed appropriate by the instructor.

## LEARNING ACTIVITY PACKAGE OUTLINE

**Summary:** A personal study of fuel and heat sources at the point of origin will encompass the following: Look for physical indications of explosion. Explosions usually involve combustible gases, flammable liquid vapors, or explosives. Look for evidence of scorched materials over a wide area and not deeply charred. Flash fires usually involve flammable vapors, gases, or flimsy solids. Extremely hot fires usually involve fuels of high B.T.U. content such as oils, greases, chemicals, rubber, and combustible metals. Electrical fires involve electrical appliances, such as overheated irons, motors, wiring, television sets, and radios. Heating appliance fires involve furnaces, stoves, wall heaters, space heaters, and cook stoves. Incendiary fires include all fires that are not accidental.

## EVALUATING STUDENT PERFORMANCE

Below is offered one method for evaluating student performance on the LAP described above. The Student Evaluation Checklist is based on observing the performance of the student for each step of the learning activity. The learning activity can be designated as one that requires limited skill (L), moderate skill (M), or proficiency (P). As the student performs each step in the LAP, the instructor can rate the student's performance as either satisfactory (S) or unsatisfactory (U).

This is an easy way to keep track of each student's performance on LAPs presented over a period of time. It also offers the instructor a means of determining which skills have been mastered and which skills have not been mastered by the student group as a whole. By reviewing these checklists periodically, the instructor can pinpoint the areas of instruction in which students need additional help. (A blank Student Evaluation Checklist is provided at the end of this section for duplication and use by the instructor.)

### STUDENT EVALUATION CHECKLIST

**Key:** **L** = Limited skill
**M** = Moderate skill
**P** = Proficiency

**S** = Satisfactory
**U** = Unsatisfactory

**Student Name:** ____________________

**Date:** ____________________

**Instructor:** ____________________

**RATING**

**L M P** **Learning Activity:** Analyze the cause of the fire.

**S U** **Steps:** 1. Obtain occupant's opinion of how fire started.

**S U** 2. Locate point of origin.

**S U** 3. Obtain occupant's description of all materials at point of origin.

**S U** 4. Gather information from firefighters, citizens, and neighbors.

**S U** 5. Conduct personal study of fuel and heat sources at point of origin.

## DEVELOPING LAPS FROM A GENERAL KNOWLEDGE CONCEPT

On the following pages is a sample LAP based on the general knowledge concept of "approximation and estimation." Again, the LAP's four components—objective, overview, learning experiences, and summary—are presented in detail. This LAP is one that students work through on their own with a minimum of interaction with the instructor.

## (SAMPLE LEARNING ACTIVITY PACKAGE BASED ON A GENERAL KNOWLEDGE CONCEPT)

## LEARNING ACTIVITY PACKAGE 1:
## APPROXIMATION AND ESTIMATION

### OBJECTIVES

When you have completed this unit, you will be correct 85% of the time when you:

1. identify whether numbers in a list are exact or approximate.
2. list reasons why a number is approximate.
3. identify the maximum error, as a tolerance, of measurements you have made.
4. rewrite a list of measurements so that they all are of the same precision.
5. measure an object to a certain degree of precision (tolerance).
6. state the relative error and degree of accuracy of a measurement.
7. round off measurements and numbers to a specified place.
8. estimate a sum, difference, product or quotient to within 10% of the actual value.

### OVERVIEW

It is impossible to exactly measure anything. There is always some amount of error in any measurement you make. In everyday life when you make measurements it is often necessary to tell how much in error your measurement is. In this learning activity you will learn about different types of errors and how to let other people know about them when they appear in your work. (The prerequisites for this LAP are satisfactory completion of the LAPs on Base 10, Number Line, Whole Numbers, Fractions, Decimals, Reciprocals, Measurement, Metric System, Averages, Percent, Ratio and Proportion, Square Roots, and Laws of Indices.)

## DIAGNOSTIC PRETEST

1. Which of the following are approximate measures? Circle the letter appearing before the measure if it is approximate.

   a. Baseball score: Pittsburgh 3, Chicago 2

   b. Enrollment of Plainview High School: 478 pupils

   c. Springfield area rainfall for 1967: 24.3 inches

   d. World's record for the 100-yard dash: 9.1 seconds

   e. Automobiles manufactured during the month of August at the Dearborn plant: 1,463

2. For each approximate measure in Question 1, write two reasons why it is an approximate measure and not an exact measure.

3. Write the maximum error, as a tolerance, for the following measurement:

   249.10 inches          maximum error = ______________

4. Rewrite the following measurements so that they are all of the same precision as the example:

   Example: $4\frac{3}{4}$ inches

   a. $6\frac{12}{16}$ inches = ______________

   b. 2.500 inches = ______________

   c. 3.000 inches = ______________

   d. $5\frac{2}{8}$ inches = ______________

5. Measure the diameter of a 25-cent piece to the nearest $\frac{1}{16}$ inch:

____________________

6. State the relative error, correct to two decimal places, for the measurement made in Question 5:

____________________

7. State the degree of accuracy, to the nearest whole percent, of the measurement made in Question 5:

____________________

8. Round off these numerals to the stated number of decimal places:

| | Numeral | Places | Rounded-Off Numeral |
|---|---|---|---|
| a. | 14.145 | 1 | ____________ |
| b. | 69.937 | 0 | ____________ |
| c. | 2410.005 | 2 | ____________ |
| d. | 3.14159 | 4 | ____________ |

9. Estimate the product of 710 and 45:

____________________

Check your answers with the teacher.

## LEARNING EXPERIENCES

As you work through the learning experiences, check your answers in the answer section at the back of this package. If you do not understand any of the questions or the answers, ask your teacher for help.

1. Choose a partner to work with you on these questions.

2. Each of you take a separate sheet of paper and independently (this means you should not show one another the piece of paper or talk over what you are doing until you are told to do so):

   a. with a yardstick, measure to the nearest 1/16" the length of the same window pane in your classroom.

   b. with a yardstick, measure to the nearest 1/16" the width of the same window pane in your classroom.

   c. with a yardstick, measure to the nearest 1/16" the height of the same supply cabinet in your classroom.

   d. count the number of students present in your classroom today.

   e. count the number of desk chairs that are in your classroom.

   Write each measurement or count on your piece of paper.

3. After both of you have measured and counted EVERYTHING in Question 2, compare your lists. Circle two of the five things you did which agree most completely on the two lists:

   a, b, c, d, e.

4. List all the reasons you can think of why the other three measurements did not agree completely between the two lists.

   ________________________________________

   ________________________________________

   ________________________________________

   ________________________________________

   ________________________________________

5. Make each statement true by crossing out the wrong word.

   a. Exact/approximate numbers are the result of measurements.

   b. Exact/approximate numbers are the result of counting.

6. Which of the following are exact or counted measures and which are approximate? Circle the correct choice.

|  |  |
|---|---|
| a. baseball score | exact, approximate |
| b. enrollment of your school | exact, approximate |
| c. annual rainfall in Pennsylvania | exact, approximate |
| d. time to run 50 yards | exact, approximate |
| e. tickets sold for the football game | exact, approximate |
| f. tractors manufactured in May | exact, approximate |

7. Which sources of error from the following list could account for one of the measures in Question 6 being approximate? Write the letter of the measurement from Question 6 after the source of error.

   a. poor eyesight _____

   b. lack of skill _____

   c. lack of experience _____

   d. haste _____

   e. expecting a certain value _____

   f. temperature _____

   g. weather conditions _____

   h. vibration _____

   i. jarring of measuring instrument _____

   j. unexpected strain on measuring instrument _____

   k. bad design of measuring instrument _____

   l. careless calibration of measuring instrument _____

   m. zero error—instrument does not read zero when not measuring anything _____

   n. matching the position of the ends of a measuring stick when the length to be measured is longer than the size of the stick _____

   o. parallax-eye, instrument scale, and object are not properly aligned _____

8. Write a brief definition of what you think "precision" is when it pertains to measurement.

Write a brief definition of what you think "accuracy" is when it pertains to measurement.

**Precision**

Rule: "The smaller the unit of measurement, the more precise the measurement."

9. Circle the most precise measurement in each series.

a. 1" 1' 1 yd.

b. 1" 10" $\frac{1}{2}$" 1'

c. $\frac{1}{2}$" $\frac{2}{4}$" $\frac{4}{8}$"

d. $5\frac{13}{16}$" $5\frac{6}{8}$" $3\frac{2}{4}$" 7"

10. Rewrite the measurements in Question 9, part d, so that they are all of the same degree of precision. (Hint: 7" may be written as $7\frac{0}{16}$".)

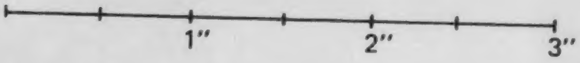
## Maximum Error

11. Precision may also be indicated as a TOLERANCE, or by stating the MAXIMUM ERROR of a measurement.

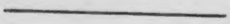
Both maximum error and tolerance depend on the smallest unit or mark that is on the scale of your measuring instrument.

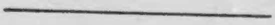
a. What is the smallest unit of measure on Scale M? ______________

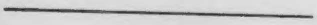
Scale M:



Using Scale M, measure the length of each of the following line segments:

X 

Y 

Z 

b. X = ______________

c. Y = ______________

d. Z = ______________

12. If line segment X were $\frac{1}{8}$'' shorter, how long would it be compared to Scale M?

______________

13. If line segment Z were $\frac{1}{8}$'' longer, how long would it be compared to Scale M?

______________

14. A line segment that is $1\frac{1}{2}$'' long would include all line segments from 1 — to 1 — on Scale M.

15. A line segment $1\frac{1}{2}$'' long could be at most ________ inches shorter or longer than $1\frac{1}{2}$'' on Scale M.

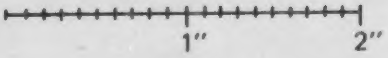
16. This length from Question 15, or one-half the smallest unit or place value of the measurement, is the MAXIMUM ERROR of the unit.

What is the maximum error of:

$1\frac{1}{2}''$ ______________

1.5" ______________

17. When you find the maximum error of measurements expressed as decimals you must take one-half of the smallest place value. Thus the maximum error of 1.5" is NOT .25". It is .05", as shown below:



Scale is divided into $\frac{1}{10}''$ units.

18. Fill in the blanks:

| | Smallest unit or place value | Maximum error |
|---|---|---|
| a. $1\frac{1}{4}$ inches | | |
| b. 1.3 inches | | |
| c. $9\frac{5}{8}$ inches | | |
| d. 12.68 feet | | |
| e. $4\frac{0}{16}$ inches | | |
| f. 3 hours 13 minutes | | |

## Tolerance

19. Tolerance is a way of expressing the maximum error along with the measurement.

The maximum error of $\frac{1}{4}''$ of a measurement of $1\frac{1}{2}''$ is expressed in tolerance form:

$$1\frac{1}{2} \pm \frac{1}{4}''$$

20. Rewrite the measurements in Question 18 with their maximum error expressed in tolerance form.

a. ____________ d. ____________

b. ____________ e. ____________

c. ____________ f. ____________

21. Suppose you measured a line to the nearest $\frac{1}{4}$" and found the measurement closer to 5" than to $4\frac{3}{4}$" or $5\frac{1}{4}$".

Why would you record the measurement as $5\frac{0}{4}$" instead of 5"?

________________________________________

________________________________________

________________________________________

## Accuracy

22. Take a piece of cardboard which is 3" long and mark one edge off into half inches. Using this new rule, measure the following to the nearest half inch:

a. the diameter of your pencil ____________"

b. the width of the arm of your desk chair ____________"

c. the height of the blackboard ____________"

23. What is the maximum error of each measurement? ____________

24. Are all the measurements in Question 22 equally precise? ____________

25. In Question 22, there is one measurement where the maximum error is more important for accuracy. Which is it: a, b, or c ? (Circle one.)

26. The diameter of the pencil is small compared to the maximum error of the instrument. This means that we will not get an accurate measurement of the diameter no matter how often we measure it.

27. As the size of the object we measured increased, the size of the maximum error became less important. We use the term "relative error" to describe how important this relationship is.

The formula for relative error is:

$$\text{Relative Error} = \frac{\text{Maximum Error}}{\text{Recorded Measurement}}$$

28. Calculate the relative error for b and c of Question 22.

relative error for b ________________

relative error for c ________________

29. Explain in your own words what the term "relative error" means.

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

30. In Question 28, which relative error is larger: b or c ? (Circle one.)

31. Based on the size of relative errors, which measurement in Question 28 was more accurate: b or c ? (Circle one.)

32. The size of a relative error indicates how accurate your measurement was. Make this sentence true by circling the correct word.

"One measurement is more accurate than another if it has a larger / smaller relative error."

33. Look at the formula for relative error in Question 27. In order for you to reduce the relative error, it is necessary for you to change only one of the other two components of the formula. Which one would you change and how would you change it (make it larger, smaller, etc.)?

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

34. A "degree of accuracy" may be found by changing the relative error into a percent, and then subtracting this from 100. An acceptable degree of accuracy for most measurements is 95%.

Convert the relative errors in Question 28 into degrees of accuracy.

degree of accuracy for b ________________

degree of accuracy for c ________________

## Rounding Off

35. To avoid all confusion when rounding off numbers, use this rule: "If the left-most digit of the part of the number to be dropped is a 0, 1, 2, 3 or 4, drop this whole part of the number."

Example: Round off 6.149 to one decimal place. Answer: 6.1

Round off these numbers to one decimal place:

a. 6.103 ________________

b. 6.113 ________________

c. 6.123 ________________

d. 6.133 ________________

e. 6.143 ________________

36. Another rule to follow when rounding off numbers is: "If the left-most digit of the part of the number to be dropped is a 5, 6, 7, 8 or 9, drop this whole part of the number and add one (1) to the final digit retained."

Example: Round off 6.159 to one decimal place. Answer: 6.2

Round off these numbers to three decimal places:

a. 6.28509 ________________

b. 6.28519 ________________

c. 6.28529 ________________

d. 6.28539 ________________

e. 6.28549 ______________

f. 6.28559 ______________

g. 6.28569 ______________

h. 6.28579 ______________

i. 6.28589 ______________

j. 6.28599 ______________

## Estimation

37. Accurate estimation requires the ability to round off numbers correctly. Estimation also implies that you are going to add, subtract, multiply or divide numbers. All of the following estimations can be made using the same technique:

"Estimate the sum of 1981 and 344."
"Estimate the difference of 1981 and 344."
"Estimate the product of 1981 and 344."
"Estimate the quotient of 1981 divided by 344."

38. Estimate the following answers:

a. The sum of 2000 and 300 is ______________.

b. The difference of 2000 minus 300 is ______________.

c. The product of 2000 and 300 is ______________.

d. The quotient of 2000 divided by 300 is ______________.

39. What change was made to the numbers used in Question 37 that resulted in the numbers used in Question 38?

______________________________________________

______________________________________________

______________________________________________

40. Every time you round off numbers that you have to add, subtract, multiply or divide so that you are working with round numbers that consist of a single, non-zero digit and zeros, you should be accurate to within 10% of the actual answer.

List three situations where you could apply this principle:

a. ______________________________

b. ______________________________

c. ______________________________

## CRITERION POSTTEST

1. Circle the letter appearing before the measure if it is an approximate measure:

   a. Football score: Kansas City 29, St. Louis 6

   b. Enrollment of Baylor Junior High School: 682 pupils

   c. Rockford area snowfall for 1966: 18.0 inches

   d. World's record for the mile: 3 minutes 51 seconds

   e. Trawlers manufactured during the month of September at the Quincy shipyards: 6

2. For each approximate measure in Question 1, write at least two reasons why it is an approximate measure and not an exact measure.

   ______________________________________________

   ______________________________________________

   ______________________________________________

   ______________________________________________

   ______________________________________________

3. Write the maximum error, as a tolerance, for the following measurement:

   8.63 seconds maximum error = __________

4. Rewrite the following measurements so that they are all of the same precision as the example:

   Example: 2.20 seconds

   a. $6\frac{1}{5}$ seconds = __________

   b. 4.859 seconds = __________

   c. $9\frac{0}{5}$ seconds = __________

   d. 1.1 seconds = __________

5. Measure the diameter of a 5-cent piece to the nearest $\frac{1}{16}$ inch:

______________________

6. State the relative error, correct to two decimal places, for the measurement made in Question 5:

______________________

7. State the degree of accuracy, to the nearest whole percent, for the measurement made in Question 5:

______________________

8. Round off these numerals to the stated number of decimal places:

| | Numeral | Places | Rounded-Off Numeral |
|---|---|---|---|
| a. | 8.1818 | 3 | ______________ |
| b. | 4.067 | 0 | ______________ |
| c. | 3.333 | 1 | ______________ |
| d. | 1.2121 | 2 | ______________ |

9. Estimate the quotient of 39,673 divided by 54:

______________________

Check your answers with the teacher.

## SUMMARY

In this unit you have learned something about types of errors that appear in measurements, some that you would like to reduce or eliminate, and others that you want to make on purpose such as in rounding off or in estimating. Whenever you must add, subtract, multiply, or divide measurements you may increase your errors unless you know what to do and exactly when to round off.

## REFERENCES

1. Glenn, W. H., & Johnson, D. A. Invitation to mathematics. Garden City, N.Y.: Doubleday,
2. Larsen, H. D., & Ludlow, H. G. Arithmetic for colleges. New York: Macmillan, 1963.
3. Rassweiler, M., & Harris, J. M. Mathematics and measurements. Dubuque, Ia.: Wm. C. Brown Book Co., 1962.

## ANSWER KEY FOR QUESTIONS 1–40

1. No answer.

2. Varies with the size of the objects.

3. d, e

4. Different for each student—accept, if logical.

5.
   a. approximate
   b. exact

6.
   a. exact
   b. exact
   c. approximate
   d. approximate
   e. exact
   f. exact

7. c and d should appear after all except n.

8. Different for each student.

9.
   a. 1"
   b. $\frac{1}{2}$"
   c. $\frac{4}{8}$"
   d. $5\frac{13}{16}$"

10. $5\frac{13}{16}$"   $5\frac{12}{16}$"   $3\frac{8}{16}$"   $7\frac{0}{16}$"

11. a. $\frac{1}{2}$"

b. $1\frac{1}{2}$"

c. $1\frac{1}{2}$"

d. $1\frac{1}{2}$"

12. 1"

13. 2"

14. $\frac{1}{4}$" $\frac{3}{4}$"

15. $\frac{1}{4}$"

16. $\frac{1}{4}$" .05"

17. No answer.

18. a. $\frac{1}{4}$" $\frac{1}{8}$"

b. .1" .05"

c. $\frac{1}{8}$" $\frac{1}{16}$"

d. .01' .005'

e. $\frac{1}{16}$' $\frac{1}{32}$"

f. 1 minute 30 seconds, or .5 minutes

19. No answer.

20. a. $1\frac{1}{4} \pm \frac{1}{8}$"
d. $12.68 \pm .005'$

b. $1.3 \pm .05$"
e. $4\frac{0}{16} \pm \frac{1}{32}$"

c. $9\frac{5}{8} \pm \frac{1}{16}$"
f. 3 hours 13 minutes ± 30 seconds

21. $5\frac{0}{4}$" shows that the measurement was made to the precision of $\frac{1}{4}$", which is correct. 5" implies the measurement was made to a precision of 1", which is incorrect.

22. Varies with the size of the objects.

23. $\frac{1}{4}$"

24. Yes

25. a

26. No answer.

27. No answer.

28. Varies with the size of the object.

29. Different for each student. Could be "Relative error describes the relationship (or compares the sizes) of the maximum error of a measurement and the measurement itself."

30. b

31. c

32. Smaller

33. Maximum error—make it smaller by measuring to a greater precision.

34. Varies with the size of the object.

35.
a. 6.1
b. 6.1
c. 6.1
d. 6.1
e. 6.1

36.
a. 6.285
b. 6.285
c. 6.285
d. 6.285
e. 6.285
f. 6.286
g. 6.286
h. 6.286
i. 6.286
j. 6.286

37. No answer.

38. a. 2300 b. 1700 c. 600,000 d. 6 (approximately)

39. They were rounded off to one digit. The digits dropped were replaced by zeros.

40. Different for each student.

## WORKSHEETS

On the following pages are blank worksheets and a student evaluation form which can be duplicated and used for developing learning activity packages for your fire cadet training program.

## Worksheet 1

## TASK LISTING

**Job:** ______________________________

**Task:** ______________________________

______________________________

**Related Tasks:**

1. ______________________________
______________________________
2. ______________________________
______________________________
3. ______________________________
______________________________
4. ______________________________
______________________________
5. ______________________________
______________________________
6. ______________________________
______________________________
7. ______________________________
______________________________
8. ______________________________
______________________________
9. ______________________________
______________________________
10. ______________________________
______________________________

Worksheet 2

## TASK ANALYSIS

Job: ______________________

Task: ______________________

Learning Conditions: ______________________

Outcome: ______________________

Learning Activity: ______________________

Steps: 1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. ______________________

Supporting Knowledge Required: ______________________

Worksheet 2 – Continued

TASK ANALYSIS

Learning Activity: ______________________________

Steps: 1. ______________________________

______________________________

2. ______________________________

______________________________

3. ______________________________

______________________________

4. ______________________________

______________________________

5. ______________________________

______________________________

Supporting Knowledge Required: ______________________________

______________________________

______________________________

______________________________

## Worksheet 3

## LEARNING ACTIVITY PACKAGE OUTLINE

Job: ______________________________

Task: ______________________________

______________________________

Learning Activity: ______________________________

Steps:
1. ______________________________
______________________________
2. ______________________________
______________________________
3. ______________________________
______________________________
4. ______________________________
______________________________
5. ______________________________
______________________________

Supporting Knowledge Required: ______________________________

______________________________

______________________________

______________________________

Worksheet 3 – Continued

## LEARNING ACTIVITY PACKAGE OUTLINE

LAP Objective: ______________________________

Overview: ______________________________

Learning Experiences:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

Worksheet 3 — Continued

## LEARNING ACTIVITY PACKAGE OUTLINE

Summary:

## STUDENT EVALUATION CHECKLIST

**Key:**
L = Limited skill
M = Moderate skill
P = Proficiency

S = Satisfactory
U = Unsatisfactory

**Student Name:** ____________________

**Date:** ____________________

**Instructor:** ____________________

| RATING | | CRITERIA | |
|---|---|---|---|
| L M P | Learning Activity: | | ____________________ |
| S U | Steps: | 1. | ____________________<br>____________________ |
| S U | | 2. | ____________________<br>____________________ |
| S U | | 3. | ____________________<br>____________________ |
| S U | | 4. | ____________________<br>____________________ |
| S U | | 5. | ____________________<br>____________________ |

# SECTION 1.7

## How to Select an Instructional Method

A better understanding of how people learn and the evolution of modern teaching and learning aids have resulted in the development of a variety of instructional methods. This section discusses eight of the most commonly used methods: lecture, conference, demonstration, performance, programmed instruction, study assignment, tutoring, and a combination of any of these.

Every instructional method has certain advantages and disadvantages, so it is important that the method selected is the one which will be most effective and efficient. Choosing an instructional method must be based on a careful analysis of the factors involved in the learning situation: instructional objectives, course content, student population, instructor, facilities, equipment, instructional materials, time, and costs. This section describes these factors as they relate to each of the eight instructional methods.

### SELECTING AN INSTRUCTIONAL METHOD

Except for the selection of training objectives, the proper selection of instructional methods will do more to promote instructional efficiency and effectiveness than any other measure. Many times this fact is overlooked in training and education. All too often the selection of instructional methods is dictated by expediency rather than choice. An instructional method or methods must be selected through systematic means if inefficiency in attaining the course objectives—or worse, failure to achieve objectives—is to be avoided.

There is no single best method of teaching which applies to all learning situations or instructional objectives. The instructor must choose the method that is most compatible with the instructional objectives, the nature of the school organization, the facilities and equipment available, the background and level of the students, and the instructor's own abilities.

**Instructional Objectives.** The accomplished instructor is one who has developed skill in using a great variety of instructional methods. For each course objective, the instructor can select from a variety of methods, one or more of which will lead to effective learning. The instructor who is limited in methods often tries to reach an objective by using inappropriate techniques. The result is a lack of student interest and attention, inefficient learning, or failure to achieve the instructional goals.

Too many instructors use only one or two methods. Many instructors lecture most of the time. Today, with the great variety of interesting and effective ways of helping students learn, the instructor should develop a repertoire of approaches. Then, rather than use the same methods for all lessons, he or she can draw from this repertoire the ones which are most appropriate for a particular situation.

**Course Content.** The nature of the course content must be considered in selecting an instructional method. The difficulty of the content and the kinds of skills and knowledge required determine to a great extent the methods which are most appropriate.

**Student Population.** The size of the student group and their educational level, prior training, aptitudes, maturity, and reading and speaking ability must be considered in selecting instructional methods.

**Instructor.** The number, quality, and competencies of available instructors is an important factor to consider in selecting instructional methods.

**Facilities, Equipment, and Instructional Materials.** Each instructional method requires the use of specific types of facilities, equipment, and materials. If the proper facilities are not available, an alternative method may be required.

**Time.** The time available for a particular block of instruction also governs the method selected. If instructional time is extremely limited, an alternative to the most effective method may be required.

**Costs.** The costs involved in using a particular method cannot be separated from the other factors. Time, facilities, personnel, and equipment all involve costs. These factors must be taken into account when selecting instructional methods.

## THE LECTURE METHOD

A lecture is a semiformal presentation by the instructor of a series of events, facts, concepts, or principles, an exploration of a problem, or an explanation of relationships. Students participate in a lecture mainly as listeners. A lecture is basically a means of telling students information they need to know. This does not mean, however, that all the talking done by the instructor during a class period can be termed a lecture. The term should be reserved to describe a more structured presentation which is used to achieve an instructional objective.

**Uses.** The purpose of a lecture is to inform. The instructor has information which he or she wishes to transmit to students by means of oral communication. Some of the more appropriate uses of the lecture are:

- to orient students to course policies, rules, procedures, purposes, and learning resources.
- to introduce a subject, indicate its importance, and present an overview of its scope.
- to give directions on procedures for use in subsequent learning activities.
- to present basic material which will provide a common background for subsequent activities.
- to set the stage for demonstration, discussion, or performance.
- to illustrate the application of rules, principles, or concepts.
- to review, clarify, emphasize, or summarize.

**Advantages.** A properly planned and skillfully delivered lecture is an effective method when used in appropriate situations. Some of the reasons why the lecture is one of the most widely used methods of instruction are that it:

- saves time. The lecture method saves time because the instructor can present more material in a given amount of time than he or she can by any other method.
- permits flexibility of class size. The size of a class is limited only by the size of the classroom to be used or the efficiency of the public address system.
- requires less rigid space requirements. The lecture can be used effectively in any type of training area, indoors or outdoors. The only requirement is that the trainees must be able to hear the lecturer.
- permits adaptability. A skillful lecturer can modify or adjust his or her materials' sequence, vocabulary, and illustrations to meet the needs of a specific group. This makes it possible to present content which is appropriate for the educational level, training, and past experience of the class.
- permits versatility. The lecture can be used for orientation, introduction, review, clarification, and summary. It can be used at any point in a course, and it can be combined easily and effectively with any other method of instruction.
- permits better control over content and sequence. Because the instructor determines what is to be presented and the order of presentation, the desired coverage and sequence can be accomplished with little danger of engaging in time-consuming detours.

**Disadvantages.** Some of the disadvantages of the lecture method are that it:

- involves one-way communication. The instructor prepares and presents the material. The student sits, listens, and takes notes. Most lectures, therefore, permit little or no interchange of ideas between the instructor and the students. All ideas presented to the class originate with the instructor.

- poses problems in skill teaching. The lecture method is an inappropriate way to teach skills such as equipment operation.

- appeals mainly to one sense. Most learning takes place through the visual sense. The lecture, even if supplemented by training aids, appeals mainly to the auditory sense. Unless the content is interesting and challenging enough to hold the attention of the class, the results are likely to fall short of the instructional goal.

- contributes to student passiveness. During a lecture, students are passive. Their job is to listen. Attention is difficult to attract and retain. Outside disturbances easily and frequently distract the students and make the lecture ineffective.

- poses evaluation problems. If an instructor is to teach rather than merely present information, he or she must be aware of student reactions, misconceptions, inattention, and difficulties, and he or she must remedy them immediately. The lecture method makes these perceptions difficult. Most students have acquired the ability to appear attentive, although they may not even be listening. The lecturer receives very little feedback, and much of what he or she does receive is often misleading.

- depends on the skill of the instructor. In a lecture, student interest and attention must be generated by the instructor. The instructor must plan carefully, display sincerity and enthusiasm, present material in a proper sequence, use appropriate vocabulary, employ effective speaking techniques, be sensitive to the reaction of the students, and modify the presentation on the basis of class response. Failure to do any of these things will result in a loss of student attention and interest, and a failure to achieve the objectives of instruction. The ultimate success of a lecture depends on the skill of the instructor.

## THE CONFERENCE METHOD

The conference is a method in which group discussion techniques are used to reach instructional objectives. These discussion techniques include questions, answers, and comments from the instructor in combination with questions, answers, and comments from the students, and are directed toward learning goals. There are three types of conferences: directed discussion, training conferences, and seminars. Clear distinctions do not exist between any of these forms; however, the objectives of the conference, and the kind and amount of student participation, determine when a directed discussion becomes a training conference, and when a training conference becomes a seminar.

The objective of a **directed discussion** is to help students acquire a better understanding of and develop an ability to apply known facts, principles, concepts, policies or procedures. The function of the instructor is to guide the student discussion in such a way that the facts, principles, concepts, or procedures are clearly articulated and applied.

In a **training conference**, the objective is to pool the knowledge and past experience of the students to arrive at improved or more clearly stated principles, concepts, policies or procedures. The topics discussed in a training conference are less likely to have pat answers than those used in a directed discussion. The task of the instructor is to elicit contributions from the group based on their past experiences which have a bearing on the topic at hand.

The purpose of the **seminar** is to find an answer to a question or a solution to a problem. The instructor does not have an answer or a solution; in fact, there is no known best or correct solution. Rather, the instructor is seeking an answer and encourages the students to develop one. The primary functions of the instructor are to describe the problem as he or she understands it and to encourage free and full participation in a discussion aimed at: identifying the real problem, gathering and analyzing data, formulating and testing hypotheses, determining and evaluating alternative courses of action, arriving at conclusions, or making recommendations to support or arrive at a solution or a decision.

**Uses.** The conference method is a valuable tool in the instructor's kit. Some of the more important applications of this method are:

- to develop imaginative solutions to problems.
- to stimulate interest and thinking, and to secure student participation in situations which would otherwise allow the class to remain passive.
- to emphasize the main teaching points.
- to supplement lectures, readings or laboratory exercises.
- to determine how well students understand concepts and principles, and to determine if they are ready to proceed to new or more advanced material.
- to prepare students for the application of a theory or procedure to specific situations.
- to summarize, clarify, or review.
- to prepare students for subsequent instruction.
- to determine student progress and the effectiveness of prior instruction.

**Advantages.** Some of the advantages of the conference method are that it:

- increases student interest. The opportunity to express one's own views and to hear the opinions of others is stimulating. Interest is unusually high in a well-planned and skillfully conducted conference.

- increases student acceptance and commitment. Because students actively participate in developing the lesson, they tend to accept the importance and validity of the content and are more deeply committed to solutions or decisions than they would be if the content were merely presented to them.

- utilizes student knowledge and experience. The conference method enables the instructor to make effective use of the students' backgrounds, previously acquired knowledge, and experiences. The entire class and the instructor benefit from the experience and thinking of all students.

- results in more permanent learning. Learning takes place in direct ratio to the amount of individual participation in the learning process. The conference demands a high degree of student participation, thereby promoting better and more permanent learning.

**Disadvantages.** Some of the disadvantages of this method are that it:

- requires highly skilled instructors. The conference is more exacting of the resourcefulness, initiative, and ability of the instructor. The instructor must be able to guide the discussion without appearing to do so. He or she must be thoroughly informed on all aspects of the subject under discussion. The instructor must also: keep the discussion on the track, minimize debate over unimportant details, relate comments to topics previously discussed, avoid reopening topics already discussed, encourage and get full participation, prevent domination by a few students, summarize each topic, and bring the discussion to a close.

- requires preparation by students. Most conferences require advance preparation in the form of reading assignments, thinking, and study before the meeting. The thoroughness of the preparation determines the quality of the discussion and the outcome of the conference. Little or no instructor control can be insured over the quality or thoroughness of student preparation. This results in variation among students in their readiness to participate in the conference.

- limits content. The content appropriate for discussion is restricted. Manipulative operations, functions, procedures, or introductory materials do not ordinarily provide suitable content for a conference.

- consumes time. Relatively large blocks of time must be allocated if a discussion is to be profitable. For this reason, the conference is often ruled out as an approach although it may be well suited to the subject and the class.

- restricts size of group. The conference method cannot be used effectively with groups larger than 12 to 15 students, because the opportunity for individual participation is too limited. More reticent members are likely to be left out of the discussion and denied valuable learning experiences.

- requires selective group composition. The members of a conference group, in most cases, must possess the proper background, maturity, and motivation if the discussion is to be profitable. The desired degree of participation is difficult to obtain if the group is composed of one subgroup which has ample experience in the area to be discussed and another subgroup which has extremely limited experience.

## THE DEMONSTRATION METHOD

A demonstration is a method of instruction where the instructor, by actually performing an operation or doing a job, shows the student what to do and how to do it, and through explanations brings out why, where, and when it is done. Usually the student is expected to be able to repeat the job or operation after the demonstration. For this reason, the demonstration is often used in conjunction with another method. The most common combinations are the lecture-demonstration and the demonstration-performance.

**Uses.** The basic purpose of a demonstration is to show how something is done. It should be employed wherever and whenever practicable. Some of its more important applications are:

- to teach manipulative operations or procedures, or how something is done.
- to teach problem-solving and analytical skills.
- to illustrate principles, or why something works.
- to teach the operation or functioning of equipment, or how something works.
- to teach teamwork, or how people work together to do something.
- to set standards of performance.
- to teach safety procedures.

**Advantages.** Some of the advantages of the demonstration method are that it:

- improves learning. Students learn faster and more permanently with a demonstration. A demonstration makes explanations concrete by giving meaning to words. Relationships between steps of a procedure and the accomplishment of the objective are clarified in a demonstration. Students not only see and hear during a demonstration, they are often given the opportunity to touch the equipment. When well planned and executed, a demonstration has a dramatic quality which arouses and sustains interest and attention.

- minimizes damage and waste. Equipment is often damaged when students attempt to operate it without proper guidance. Much of this damage and waste can be prevented by the use of demonstrations.

- saves time. A properly planned demonstration takes much less student time than other methods. It reduces oral explanation time and at the same time prevents misunderstandings about how a system or a piece of equipment works.

- can be presented to large groups. Class size is limited only by the ability of the group to see the object being demonstrated. The use of large-scale mockups or models makes it possible to teach many operations to large classes.

**Disadvantages.** Some of the disadvantages of this method are that it:

- requires careful preparation and rehearsal. A demonstration should set a standard of performance for students. The procedure must be technically correct and must be performed with a skill greater than that expected of students. The instructor must be sure that the equipment is in working order. Nothing fails as completely as a demonstration that doesn't work.

- requires special classroom arrangements. The demonstration room must be set up so that all students can clearly see every phase of the demonstration.

- requires equipment and aids. The equipment, often expensive, must be taken out of an operational setting. Therefore, the removal of this equipment must be offset by gains in training. Sometimes, models or mockups must be purchased or constructed. These represent a rather costly investment of time, money, and other resources.

## THE PERFORMANCE METHOD

The performance method requires the student to perform, under controlled conditions, the operation, skill, or movement being taught. Performance is learning by doing.

There are four basic types of performance. **Independent practice** requires students to work individually at their own pace. In **group performance or controlled practice**, students work together step-by-step at the rate set by the instructor. The **coach and pupil** method involves pairing students. Members of each pair perform alternately as instructor and student. In **team performance**, a group of students perform an operation or function as a team.

**Uses.** In general, the performance method has the same applications as the demonstration method and is used as follow-on instruction.

- to teach manipulative operations or procedures.

- to teach the operation or functioning of equipment.

- to teach team skills.

- to teach safety procedures.

**Advantages.** The main advantages of the performance method are that it:

- builds confidence. Given the opportunity to apply their knowledge in a realistic situation, students develop confidence in their ability and a positive attitude toward the learning situation.

- increases learning. Active student participation is maximized. This fact, coupled with the interest and attention generated by putting theory into practice, increases both the amount and the permanence of learning.

- enables learning evaluation. With the performance method the instructor has an opportunity to observe the degree of learning attained by each student, to identify students having difficulty, and to determine if there have been weak areas in the instruction.

- reduces damage and waste. Because performance is guided, students are less likely to make mistakes which will damage equipment or waste materials.

- promotes safety. Guided performance makes it possible to emphasize the proper method of performance and helps prevent accidents.

**Disadvantages.** Some of the disadvantages of the performance method are that it:

- requires tools and equipment. If a practical exercise is to be conducted, every student must participate fully. Therefore, tools and properly functioning equipment must be available in sufficient quantity for the size of the class.

- requires large blocks of time. A well-run practical exercise is often time-consuming in its requirements for setting up the room and equipment, and in accomplishing the actual setting up of the room and equipment for individual or team performance of the complete operation.

- requires more instructors. Unless the class is very small, a number of qualified instructors are required to keep a constant check on the progress of each student, to give assistance when needed, and to evaluate the quality of the performance.

## PROGRAMMED INSTRUCTION METHOD

Programmed instruction is a method of self-instruction in which the student works through a carefully sequenced and pretested series of steps leading to the acquisition of knowledge or skills representing the instructional objectives. The student proceeds through the program at his or her own rate, responds actively to each step in the sequence, and receives immediate feedback on the correctness of his or her response before proceeding to the next step. Programs are usually designed to permit the student to master the desired knowledge or skills

**Uses.** The programmed instruction method can be used:

- to provide remedial instruction.

- to provide makeup instruction for late arrivals, absentees, or transients.

- to maintain previously learned skills which are not performed frequently enough to insure an acceptable level of proficiency.

- to provide retraining on equipment and procedures which have become obsolete or have been replaced since the original training was given.

- to upgrade production, administrative, or other types of skills and knowledges.

- to accelerate capable students and thereby enable them to complete a course in less than the usual amount of time.

- to provide a means of insuring enough common background among students to profit from formal classroom work.

- to provide the review and practice of knowledge and skills needed to "set" the learning.

- to provide a source of vertical enrichment (advanced work) or horizontal enrichment (broader contact) in a content area.

- to control the variables in a learning situation for experimental purposes.

**Advantages.** The advantages of programmed instruction are that it:

- reduces the failure rate. The student failure rate is reduced because programs are tested and validated before they are used. This procedure insures that the program is effective in performing the instructional job. The self-pacing feature of the material also helps, because students are exposed to the material at a rate which is appropriate for each individual. The "forced" response and immediate confirmation features guarantee continuous attention to the material, correct wrong responses, and prevent misinterpretation and the practice of errors.

- improves end-of-course proficiency. The pretesting, self-pacing, forced attention, and immediate feedback features of programs result in better, more efficient, and more permanent learning. Thus, end-of-course proficiency is markedly increased.

- saves time. The rigid control over content made possible by the procedures used for developing, testing, and validating programs prevents the introduction of unnecessary content and thereby reduces the time required to learn the critical material. The self-pacing feature, along with forced attention, decreases the teaching time required, and frequently results in an average time savings of 30 percent or more over conventional instructional methods.

- standardizes instruction. The instructional content and sequence of a program are predetermined. They are not subject to the whims, preferences, experiences, or biases of the instructor. The quality of instruction does not vary from day to day nor from instructor to instructor. There is almost complete control over the content, sequence, and form of student responses. Hence, instruction becomes standardized and can be repeated without change at any time for any individual or group.

- requires no special facilities. Programmed materials can be used anywhere at any time. No specially equipped rooms or facilities are necessary.

- provides for self-instruction. Although under ordinary conditions programs are not used as substitutes for instructors, they can be so used. Programs are validated under conditions where they alone do the teaching. Therefore, they are effective instructional materials even if no qualified instructor is available.

- accommodates student differences. Programs can be designed to accommodate wide differences in aptitude, ability, speed of learning, prior training, and experience. The needs of students, whether for more or less exposure, detail, or practice, can be met. The size of a class is also unimportant. Programs can be used to achieve group or individual progress.

- improves efficiency and economy for group or individual instruction. The self-pacing feature and the handling of large or small groups make for greater efficiency and economy. In addition, programs free instructors from routine, repetitive teaching tasks and enable them to spend a larger part of their time on more difficult or more demanding aspects of instruction.

**Disadvantages.** The disadvantages of the programmed instruction method are that it:

- requires local or commercial preparation. Although the number of available programs is growing rapidly, those which may be used locally are limited. Most programs produced by commercial publishers or other sources do not match the instructional objectives of local courses. For this reason, programs must be developed locally or contracted with commercial programming companies.

- requires lengthy programmer training. Very few trained programmers are available locally. The training program is relatively lengthy and demanding. Only a small percentage of persons exposed to programmer training will become competent programmers.

- increases expenses. Programs, whether developed locally or contracted, are extremely costly. For local development there must be a large investment in programmer training and an even larger one in program writing, testing, and validation. Program development by contract is expensive, and the time required by subject-matter experts and technicians for consulting with programmers and reviewing draft materials is considerable.

- requires considerable lead time. Programmed materials cannot be selected or developed quickly. Lead time is required to screen and select appropriate programs from those available. If programs are developed by school staff or contract programmers, the lead time for production, testing, and validation is even greater. If the course content is unstable or subject to frequent and radical change, it is inappropriate for programming.

- demands competent instructors. Instructors must be able to motivate students to complete programs. They must be able to assist any student at any point in the programmed sequence. If instructors are to be able to provide the motivation, guidance, and assistance required for the optimum use of programmed materials, they must have: insight into the learning process; a thorough understanding of the rationale, principles, construction, and use of programming; skill in conducting tutorial-type instruction and individual counseling; and a mastery of the subject matter of the programs used.

- requires mature students. The use of programs requires a student group which is mature enough and sufficiently well motivated to work independently. Also, they must be able to read at the level required for full understanding of the program.

- poses administrative problems. The use of programmed materials creates unique administrative problems. Foremost among these are the scheduling and assignment problems caused by the self-pacing feature of programs. This feature results in different phase and course completion times with consequent difficulties in scheduling following instruction and assigning graduates to field units.

## THE STUDY ASSIGNMENT METHOD

The study assignment is a method in which the instructor assigns readings in books, periodicals, manuals, or handouts; requires the completion of a project or research paper; or assigns problems and exercises for the practice of a skill. This method involves imposing a task, providing for student motivation, and giving general directions for carrying out the assignment. Implicit in this method are the problems of setting up worthwhile learning activities and anticipating student difficulties and means of overcoming them. If these steps are not well handled, the objectives of the assignment are not likely to be achieved.

The study assignment has two basic forms. In an **independent study** the student carries out the assignment without instructor assistance or direct guidance. In a **supervised study** the student carries out the assignment with an instructor available for guidance and assistance.

**Uses.** The study assignment method can be used:

- to orient students to a topic prior to classroom or laboratory work.
- to set the stage for a lecture, demonstration, or discussion.
- to provide for or capitalize on individual differences in ability, background, or experience through differentiated assignments.
- to provide for the review of material covered in class or to give the practice essential for the development of skills and problem-solving ability.
- to provide enrichment material.

**Advantages.** Some of the advantages of the study assignment method are that it:

- increases coverage of material. A far greater amount of material, and detailed treatment of it, can be covered in a shorter period of time by study assignments than by any other means.

- reduces classroom time. Used properly, study assignments can serve as a substitute for lectures; study assignments can make lectures, demonstrations, and conferences more meaningful and more productive.

- improves learning. Practice is essential to the development of skills. Study assignments provide a means of giving enough practice to insure mastery of the skill.

- permits individualized attention. Study assignments can be designed to make use of the experience, special skills, or interests of students, or to remedy individual deficiencies in skill or knowledge.

- reduces instructor interpretation. Students may be referred to the original source instead of being exposed only to the instructor's interpretation. This insures that the content will be presented as intended by the originator of the material.

**Disadvantages.** Some of the disadvantages of this method are that it:

- requires careful planning and follow-up. If students are not well motivated, they are not likely to do a thorough job with assignments, especially those which they must do on their own. The instructor must plan and assign work in such a way that the objectives and instructions are clear and the motivation is present. The instructor also must follow up to insure that the assignment has been carried out.

- poses evaluation problems. The effectiveness of study assignments is difficult for an instructor to evaluate. It is also difficult for him or her to determine what went wrong with a study assignment when the results are not as good as anticipated.

- results in the practice of errors. In skill development it is critical that the skill be practiced in the prescribed mode. Particularly with independent practice, there is a danger that the student will practice an incorrect procedure or error. When this occurs, a large expenditure of time is required to "unlearn" the skill and "relearn" it correctly.

- produces nonstandard results. The variations in reading ability and differences in motivation in any group produce varying degrees of learning when study assignments are used. Where standardization of learning is essential, study assignments may be inappropriate.

## THE TUTORING METHOD

Tutoring is a method of instruction in which an instructor works directly with an individual student. The method may involve exposition, demonstration, questioning, coaching, or guided practice.

**Uses.** Tutoring can be used:

- to teach highly complex skills and operations, or operations which involve potential danger to students or hazards to expensive equipment.

- to provide individualized remedial assistance.

**Advantages.** Some of the advantages of tutoring are that it:

- permits adaptive instruction. Tutoring provides the optimum in individualized instruction. The needs of the individual student can be diagnosed and instruction can be tailored to meet his or her unique needs.

- stimulates active participation. In a tutorial setting, the highest possible degree of student participation can be achieved. Direct involvement in the learning, by answering and asking questions, by performing under supervision, is guaranteed.

- promotes effective learning. The ability of the tutor to adapt instruction to the needs of the individual, together with the high degree of interaction and participation of the student, make this method extremely effective in achieving instructional objectives.

- promotes safety. The one-to-one instructor-student ratio provides close control over performance of hazardous operations, resulting in the prevention of injury to the operator or damage to the equipment.

**Disadvantages.** Some of the disadvantages of this method are that it:

- requires highly competent instructors. Tutoring is one of the most demanding types of instruction to conduct. It requires complete mastery of the content and skill in diagnosing and remedying learning difficulties.

- demands time and money. Tutoring is probably the most expensive method of teaching. Although only one student is receiving instruction, instructor preparation and presentation time are essentially the same as they would be for a whole class of students.

## THE COMBINATION METHOD

This is a method of instruction which uses two or more basic instructional methods in combination. For example, one lesson might include a study assignment, a lecture in which safety precautions in handling a piece of equipment are emphasized, a demonstration by the instructor, and, finally, performance by the students.

**Uses.** Combination lessons can be used to meet almost any type of instructional objective in any training situation. However, they are most appropriate where skill development is involved.

**Advantages.** The advantages of using a combination of methods are that they:

- increase interest. The variety of methods used in a combination lesson make for a more interesting and engaging instructional period.

- promote flexibility. The use of several methods frees the instructor from the restricting or limiting aspects of any single method. He or she can easily adjust the lesson to the needs of the class and the requirements of the situation.

- improve learning. The combination lesson maximizes the advantages of any single method. It allows the instructor to use approaches which complement each other. This fact, plus the advantage of higher student interest, results in improved learning.

**Disadvantages.** The disadvantages of using a combination of methods are that they:

- require highly skilled instructors. Instructors must be able to use all methods of instruction with a high degree of skill.

- require smaller groups. The use of methods in combination requires closer control by the instructor and better supervision of student activities. To obtain the desired control, classes must be kept small.

# SECTION 1.8

## Teaching-Learning Resources for the Instructor

Section 1.8 provides the instructor with a variety of instructional resources and references for use in fire cadet curriculum development efforts. Listed here are audio-visual resources, texts and reference materials, sources of career opportunities and educational development information, and sources of additional information and assistance.

### AUDIO-VISUAL RESOURCES

**International Fire Service Training Association, Fire Protection Publications, Oklahoma State University, Stillwater, Oklahoma 74074** (Catalog available upon request.)

No. 204-S: Sprinkler Slides (75 color slides to supplement the Sprinkler course)

No. 102-S: Ladder Slides (66 color slides to supplement the Ladder course)

No. 104-S: Salvage Slides (83 color slides to supplement the Salvage course)

**National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts 02210** (The materials listed below are a small sample of the slides and films available from the NFPA. A free catalog may be obtained upon request. Discounts are available to educational institutions.)

**Special Training Films for Fire Departments**

Tank Vehicle Fire Fighting (25 minutes, 16mm, color, sound)

Handling LP-Gas Emergencies (25 minutes, 16mm, color, sound)

Aerial Apparatus (30 minutes, 16mm, color, sound)

Ventilation (27 minutes, 16mm, color, sound)

Instant Arson—Controlling Incendiarism (12 minutes, 16mm, color, sound)

**Public Instruction Films on Fire Prevention**

Are We Fire Safe? (8 minutes, 16mm, color, sound)

Sound the Alarm! (11 minutes, 16mm, color, sound)

Liquids Can Burn (12½ minutes, 16mm, color, sound)

Help Prevent Fires (12 minutes, 16mm, color, sound)

Close Up on Fire (54 minutes, 16mm, color, sound)

The Nature of Fire (19 minutes, 16mm, color, sound)

High-Rise Buildings, Fire Safety, and You (12 minutes, 16mm, color, sound)

**Slides**

Fire Problems of Wood Construction (50 slides, manual)

Fire Problems of Steel Construction (50 slides, manual)

Aerial Ladders (41 slides, manual)

Fighting Tank Fires with Water (36 slides, manual)

**San Diego Technology Action Center, 202 C Street, San Diego, California 92101**

A fire simulator that enables trainees to evaluate fires and determine the strategy for fighting them in the safety of a classroom has been developed by a San Diego firefighter, Captain Edward E. Wright. The device not only gives trainees a chance to size up the blaze and conduct firefighting strategy, but it also enables them to select buildings actually in their districts, simulate fires in them, and learn procedures relevant to those particular structures.

The fire simulator uses a two-stage overhead projector in combination with a slide projector. Through use of a slide, an image of a building, a wooded canyon, an airplane or any other object that might burn is projected onto a screen. Then, one stage of the overhead projector produces a reddish-orange flickering light that presents the illusion of fire. The other stage projects a flickering gray light that simulates smoke. Both the simulated fire and smoke are superimposed over the "burning" object.

The simulator operator can allow fire and/or smoke to appear at any area desired: at windows, through the roof, or in doorways. The simulated blaze can be extended vertically or horizontally. The operator can restrict the firelight to give the illusion that the blaze is being extinguished, or can extend the light to make it appear that the fire is spreading.

Besides giving trainees a chance to conduct fire strategy in a controlled atmosphere, the new device can help with training on radio procedures.

The simulator, which took only 16 hours to construct, costs about $125 to build. Additional information and free plans for the training device may be obtained from Captain Wright at the above address.

## TEXTS AND REFERENCE MATERIALS

**Arco Publishing Company, Inc., 219 Park Avenue South, New York, New York 10003**

**Test Preparation Aids**

Battalion and Deputy Chief

Captain

Fire Administration and Technology

Firefighting Hydraulics

Fireman

Lieutenant

1340 Questions and Answers for Firefighters

**Glencoe Press, 8701 Wilshire Boulevard, Beverly Hills, California 90211**

Fire Suppression and Detection Systems. John L. Bryan, 544 pp., 1974.

Introduction to Fire Science. Loren S. Bush and James McLaughlin, 396 pp., 1970.

Fire Company Apparatus and Procedures. Lawrence W. Erven, 360 pp., 1974.

Techniques of Fire Hydraulics. Lawrence W. Erven, 342 pp., 1970.

Fire Department Management: Scope and Method. David B. Gratz, 373 pp., 1972.

Explosive and Toxic Hazardous Materials. James Meidl, 387 pp., 1970.

Flammable Hazardous Materials. James Meidl, 308 pp., 1970.

Hazardous Materials Handbook. James Meidl, 360 pp., 1972.

Introduction to Fire Prevention. James C. Robertson, 556 pp., 1975.

**International Fire Service Training Association, Fire Protection Publications, Oklahoma State University, Stillwater, Oklahoma 74074** (Catalog available upon request.)

**Methods and Techniques Manuals**

No. 101: Forcible Entry, Rope, and Portable Extinguisher Practices

No. 102: Fire Service Ladder Practices
No. 103: Fire Hose Practices
No. 104: Salvage and Overhaul Practices
No. 105: Fire Stream Practices
No. 106: Fire Apparatus Practices
No. 107: Fire Ventilation Practices
No. 108: Fire Service Rescue and Protective Breathing Practices
No. 109: Fire Service First Aid Practices
No. 110: Fire Inspection Practices

### General Fire Service Training Manuals

No. 201: Fire Service Practices for Volunteer Fire Departments
No. 202: An Introduction to the Fire Service
No. 203: Fire Service Training Programs
No. 204: Fire Department Support of Automatic Sprinkler Systems
No. 205: Water Supplies for Fire Protection
No. 206: Aircraft Fire Protection and Rescue Procedures

### Officer Training Manuals

No. 301: The Fire Department Officer
No. 302: Fire Department—Facilities, Planning and Procedures
No. 303: Fire Service Instructor Training

### Informational Texts

No. 401: Fundamental Principles of Mathematics
No. 402: Fundamental Principles of Science
No. 403: Leadership in the Fire Service

**McGraw-Hill Book Company, Order Services, Manchester Road, Manchester, Missouri 63011**

Fire Protection and Suppression. Robert Colburn, 352 pp., 1975.

Fire Fighting Hydraulics. Robert C. Purington, 416 pp., 1974.

Firefighting Strategy and Leadership. C. Walsh, 262 pp., 1963.

**National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts 02210** (The materials listed below are a small sample of the books and manuals available from the NFPA. A free catalog may be obtained upon request. Discounts are available to educational institutions.)

**Codes, Standards, Recommended Practices, Manuals**

National Fire Codes (1975 edition, 15-volume set)

Organization of a Fire Department

Installation, Maintenance and Use of Portable Fire Extinguishers

Respiratory Protective Equipment for Fire Fighters

Fire Department Ladders, Ground and Aerial

Flash Point Index of Trade Name Liquids

Code for Explosive Materials

Dust Explosion Prevention in Feed Mills

Automatic Fire Detectors

Standard Glossary of Terms Relating to Chimneys, Vents and Heat-Producing Appliances

Aircraft Fire Investigators Manual

Fire Fighter Professional Qualifications

**Building Codes Libraries**

Construction Library

Fire Protection Library

Health Care Safety—Fire Protection Systems Library

**Recent Occupancy Fire Safety Studies and Reports**

- Occupancy Fire Records
- Fire Loss Studies
- High-Rise Building Fires and Fire Safety

**Fire Officer's Guides Series**

- Operating Fire Department Pumpers
- Fire Officer's Guide to Extinguishing Systems
- Fire Officer's Guide to Emergency Action
- How to Judge Your Fire Department

**Other Books and Manuals**

- The Extinguishment of Fire
- Fire Behavior and Sprinklers
- Handling Hose and Ladders
- Fire Fighting Tactics
- Measuring Fire Protection Productivity in Local Government

## SOURCES OF CAREER OPPORTUNITIES, INFORMATION, AND ASSISTANCE

American Association for Vocational Instructional Materials, Engineering Center, Athens, Georgia 30602

American Technical Education Association, North Dakota State School of Science, Wahpeton, North Dakota 58075

American Vocational Association, Inc., 1510 H Street, N.W., Washington, D.C. 20005

Fire Marshals Association of North America, 470 Atlantic Avenue, Boston, Massachusetts 02210

International Association of Arson Investigators, P.O. Box 1208, Springfield, Illinois 62705

International Association of Fire Chiefs, 1725 K Street, N.W., Washington, D.C. 20006

International Association of Fire Fighters, 1750 New York Avenue, N.W., Washington, D.C. 20006

National Association of Fire Investigators, 53 West Jackson Boulevard, Chicago, Illinois 60604

National Association of Industrial and Technical Teacher Educators, Kearney State College, Kearney, Nebraska 68847

National Association of State Directors of Vocational Education, 2805 Eisenhower Street, Eau Claire, Wisconsin 54701

National Employment Counselors Association, 1607 New Hampshire Avenue, N.W., Washington, D.C. 20009

National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts 02210

National Vocational Guidance Association, 1607 New Hampshire Avenue, N.W., Washington, D.C. 20009

Society of Fire Protection Engineers, 60 Batterymarch Street, Boston, Massachusetts 02110

# PART TWO

# GUIDE FOR STUDENT SELECTION AND PLACEMENT IN THE TRAINING PROGRAM

# SECTION 2.1

## How to Use Part Two of the Guide

Part Two of the guide offers the school guidance counselor career information and recommends a set of steps that can be used to determine criteria for student selection and placement in the training program. The guidance counselor should become familiar with the sections presented in Part Two so that effective guidance activities, corresponding to the intent of the curriculum, can be carried out. In addition, Sections 1.2 and 1.3 of Part One are essential to the guidance process and should be reviewed by the guidance counselor.

**STEP 1: Review how the guide was developed.** Read Section 1.2, "How the Guide Was Developed," to gain a thorough understanding of the structure and development of the guide and to become familiar with these key concepts and terms: occupational analysis, career ladder, worker trait group, task statement, task inventory, and general knowledge concept.

**STEP 2: Review the information on the career field.** Read Section 1.3, "General Job Description: Firefighter," for a comprehensive overview of the career field, descriptions of the type of work performed, employment forecasts, and other important career information.

**STEP 3: Know the use and function of the Dictionary of Occupational Titles.** If you have not already done so, you should become familiar with the use and function of the Dictionary of Occupational Titles and its supplements, which are available from the U.S. Department of Labor. These documents are the foundation upon which the fire cadet training program and guidance activities are built.

**STEP 4: Study the fire cadet qualifications profile.** Section 2.3, "Qualifications Profile for the Entry-Level Fire Cadet," presents a composite profile of the entry-level worker and is based on the principal worker trait group associated with firefighting from the Dictionary of Occupational Titles. This profile can be used in preliminary screening activities and counseling students who want to enter the training program. Section 2.5, "Worker Trait Codification System," explains in full the knowledge, aptitude, and interest levels associated with this worker trait group.

**STEP 5: Determine the General Educational Development (GED) level of students.** One part of the qualifications profile is a suggested level of competence related to general educational development. Section 2.2, "Career Guidance for Fire Cadet Occupations," includes a description of the General Aptitude Test Battery (GATB) which can be used to determine the GED level of students as well as their aptitudes and interests.

**STEP 6: Use the Advanced General Education Program for GED remediation.** Section 2.4 provides a description and list of instructional units contained in the Advanced General Education Program. All or parts of this program can be used for remediation purposes based on the administration of the GATB.

**STEP 7: Provide guidance for students who leave the program or who do not qualify.** The results of the GATB, when used in conjunction with the qualifications profile, provide a useful starting point for counseling students who drop out of the program or whose interests, aptitudes, and GED level do not seem appropriate for the career field.

**STEP 8: Coordinate your guidance activities with the instructor.** Review the sections in Part One of the guide to gain an understanding of how the curriculum and instructional development activities correspond to the recommended guidance activities. Discuss student selection and placement activities with the instructor in order to better coordinate your efforts.

# SECTION 2.2

# Career Guidance for Fire Cadet Occupations

Part Two of this guide is based on an extensive pool of career and job information maintained by the U.S. Employment Service and the Department of Labor. This and associated information is widely used by federal, state, and local governments, industry, private agencies, companies and institutions in hiring and placing workers and in defining worker duties, tasks, and activities.

By using Part Two in conjunction with the General Job Description (Section 1.3) and the Inventory of Job Tasks (Section 1.4), the guidance counselor will be able to:

- provide students with useful career decision-making information based on their interests, aptitudes, and previous educational experience.
- determine the General Educational Development (GED) level of individual students as it relates to the career field.
- determine the prerequisite learning needs of a student prior to his or her placement in the training program.

The guidance materials are a response to the many social factors which converge to stimulate interest in the career development needs of young people. All of these factors have in common the search for a set of values which will give meaning and usefulness to students' lives. Among the most important of these social factors are:

- the growing complexity in the occupational and organizational structure of society which makes it difficult for a person to assimilate and organize the data necessary to choose a career.
- the increasingly rapid rate of technological change which demands human adaptability and responsiveness.
- the increasing national concern for developing all human talent regardless of sex, age, religion, or ethnic origin.
- the need for specialized training to obtain entry-level jobs.
- the apparent disenchantment expressed by students who have difficulty relating their education to their lives.

The evolving view of a job is that it should be considered as one step in an integrated, life-long career. A job is a step on a career lattice involving both horizontal and vertical dimensions: horizontally, it involves a pattern of choices at one point in time; vertically, it involves choices over a period of time.

Career guidance should not be viewed as a static, tradition-based set of services that assists students in making simple occupational choices. Guidance must be developed from an initial assessment of the present and future career needs of students and must account for changes in the career field that could affect the development and fulfillment of students' expectations. The content of a guidance program can be organized in many ways to facilitate the student's development. Whatever its form, however, the program ultimately should encourage a student to assume responsibility for his or her own career development.

A career guidance program based on the counselor's experience, expertise, and use of the information presented here will help the student assimilate and integrate knowledge, experience, and appreciation related to the following career development efforts:

- self-understanding, which includes a person's relationships to his or her own characteristics and perceptions, to others, and to the society.

- an understanding of the world of work and those factors that affect its constant changing, including worker attitudes and disciplines.
- an understanding of the many factors to be considered in career planning.
- an understanding of the information and skills necessary to achieve self-fulfillment in work and leisure.

Section 2.2 is intended to facilitate the process of placing students in the training program. It provides techniques for determining the General Educational Development (GED) level of an individual and relating it to the GED level required for the job. Also presented is a description of the General Aptitude Test Battery, which can be used to determine students' aptitude and interest levels.

## DEFINITION OF GENERAL EDUCATIONAL DEVELOPMENT*

General Educational Development (GED) can be defined as education of a general academic nature, ordinarily obtained in elementary school, high school, or college, which does not have a recognized, fairly specific occupational objective; this type of education also may be derived from experience or self-directed study. GED is composed of three types of development: reasoning, mathematical, and language.

**Reasoning development** involves the capacity to comprehend concepts and systems, solve problems, exercise judgment, and understand and carry out instructions, as well as to adapt to social and work environments.

**Mathematical development** is the acquisition of basic mathematical skills, not specifically vocationally oriented, such as solving arithmetic, algebraic, and geometric problems.

**Language development** includes the acquisition of language skills, not specifically vocationally oriented, such as mastery of an extensive vocabulary; use of correct sentence structure, punctuation, and spelling; and an appreciation of literature.

Mathematical and language development are "tool languages" which, although not specifically vocationally oriented, involve basic preparation for specific vocational goals. The descriptions of the various levels of language and mathematical development (see Section 2.5) are based on the curricula being taught at specified grade levels in schools throughout the country. An analysis of mathematics courses in the school curricula revealed distinct levels of progression in the primary and secondary grades and in college. These levels of progression facilitated the selection and assignment of six levels of GED for the mathematical development scale.

Though language courses follow a similar pattern of progression through completion of high school, consisting primarily of learning and applying the principles of grammar, this pattern breaks down at the college level. The diversity of fields of study at the college level precluded establishment of distinct levels of language development for these four years. Consequently, both GED Level 5 and Level 6 are defined by one language curriculum.

## USING THE GED LEVELS FOR STUDENT PLACEMENT

In matching the student to the occupational program, it is essential to obtain all occupationally significant information about the student. Appraisal of the student in terms of his or her GED is based on such data as:

- school achievement, including grade level attained, subjects studied, standing in class, and honors or special recognition in specific subjects.
- special courses, either military or civilian.

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* Excerpted from "Relating General Educational Development to Career Planning," U.S. Dept. of Labor, Manpower Administration.

- results of tests which measure the degree of academic achievement or general intelligence.

- vocational and personal achievements in any previous work situations.

- general demeanor and ability to communicate.

These data can be related to an appropriate academic level on the GED chart in Section 2.5. For example, a student who has completed the eighth grade in school and achieved a B average in arithmetic, with C's and B's in other subjects, appears to be at an academic level which relates to GED Level 3.

If more information is needed to make a final determination, the guidance counselor can probe into the courses studied by the student to insure that the school curriculum meets the standards reflected in the curriculum for Level 3 on the GED chart. It should be remembered that a student sometimes has a higher educational development than his or her formal education presupposes, and in such a case he or she should be identified at a higher, more appropriate level.

The primary purpose of determining the GED level of a student is to provide a criterion for use with other information in relating him or her to suitable vocational goals, whether through immediate employment or through additional education and training. All information about the student—the evaluation of his or her aptitudes, interests, and personality characteristics, GED level, and any test results—can be related to areas of work, groups of jobs, and specific jobs in the Worker Traits Arrangement of the Dictionary of Occupational Titles. The most important information relating to fire cadet occupations and worker trait groups is presented in Section 2.3. (A more detailed description of the worker trait codification system appears in Section 2.5.)

The qualifications profile in Section 2.3 includes the GED reasoning, mathematical, and language development levels required for entry-level fire cadets. These GED levels indicate the degree of educational development, formal or otherwise, which the worker should possess for average satisfactory job performance. By relating the GED level of the student to that required for the fire cadet, the guidance counselor can do a better job of helping students select vocational goals.

The subject matter areas listed in the GED chart in Section 2.5 can be used in planning basic or supplementary general education for students in the training program or advising a student on the educational basis required for functioning in this career field.

The GED levels listed in the qualifications profile in Section 2.3 constitute the prerequisites for effective job performance at the entry level. Should the prerequisite GED be missing in a candidate for fire cadet training, then the student should be directed to a more appropriate program of occupational training.

If the student is selected for the fire cadet training program on the basis of other criteria, then steps must be taken to provide him or her with academic training that will raise his or her GED to the desired level. Otherwise, the student will be handicapped in his or her ability to handle the course content of the training program and to perform the required duties and tasks while on the job.

A student who is deficient in prerequisite GED should be encouraged to participate in the Advanced General Education Program (see Section 2.4) either before becoming involved in training or during the fire cadet training program.

## GENERAL APTITUDE TEST BATTERY

Another useful tool in placing students in the fire cadet occupations training program is the General Aptitude Test Battery (GATB). The GATB was developed in conjunction with the occupational counseling services of the U.S. Employment Service. According to its developers, the GATB "is designed to measure several aptitudes which have been found important to success in many occupations." The battery is used primarily as an aid in the more effective placement of applicants who have insufficient job experience. Various state agencies, in cooperation with local school authorities, have been extending the application of the battery to the counseling of high school students.

The battery consists of 15 tests: 11 paper-and-pencil and four apparatus tests. It requires approximately 2½ hours for completion. The tests are designed to measure nine basic aptitudes for 20 fields of work including approximately 2,000 of the occupations classified in the Dictionary of Occupational Titles (D.O.T.). The nine aptitudes are: Intelligence (G), Numerical (N), Verbal (V), Spatial (S), Form Perception (P), Clerical Perception (Q), Motor Speed (T), Finger Dexterity (F), and Manual Dexterity (M).

The qualifications profile presented in Section 2.3 of this guide is derived from the D.O.T. and relates directly to the aptitudes measured in the GATB. For more information on obtaining, administering, and interpreting the results of the General Aptitude Test Battery, contact the local office of the Illinois State Employment Office.

# SECTION 2.3

## Qualifications Profile for the Entry-level Fire Cadet

The qualifications profile contained in this section of the guide is based on an analysis of the essential worker traits for the occupation of firefighter. The analysis utilized the Dictionary of Occupational Titles and is supplemented by the Handbook for Analyzing Jobs and the Handbook on Relating General Educational Development to Career Planning. All three documents are publications of the U.S. Department of Labor.

Worker traits are defined as the abilities, personal traits, and individual characteristics necessary for a worker to achieve average successful job performance. The qualifications profile provides the broadest and most comprehensive framework for the effective presentation of worker trait information in the career field.

This profile, and the task inventory developed around it (see Section 1.4), are seen as a natural basis upon which to select students for training and provide career counseling. Within this framework, the guidance counselor will find a qualifications profile which indicates:

- the amount of general educational development and specific vocational preparation a worker must have.
- the specific capacities and abilities required of the worker in order to learn or perform certain tasks or duties.
- preferences for certain types of work activities or experiences considered necessary for job success.
- types of occupational situations to which an individual must adjust.
- physical activities required in work situations.
- physical surroundings prevalent in jobs.

All of this information can be used for placing students in or orienting them to the training program, when used in conjunction with the General Job Description (Section 1.3) and the Inventory of Job Tasks (Section 1.4).

## QUALIFICATIONS PROFILE

The qualifications listed for successful performance as an entry-level fire cadet are minimally acceptable standards of accomplishment necessary at that level.* (Section 2.5, "Worker Trait Codification System," presents a complete explanation of the levels and codification system used.)

The qualifications listed do not relate to performance requirements existing at higher levels within the career field. In order to progress within the field, the student must have the ability to attain higher-level capabilities through a combination of training and work experience so as to progress up the career ladder.

### General Educational Development (GED) Requirements

| | |
|---|---|
| **Reasoning Development, Level 3:** | Applies common-sense understanding to carry out instructions furnished in written, oral, or diagrammatic form. Deals with problems involving several concrete variables in or from standardized situations. |
| **Mathematical Development, Level 3:** | Make arithmetic calculations involving fractions, decimals, and percentages. |
| **Language Development, Level 3:** | **Reading.** Read a variety of novels, magazines, atlases, and encyclopedias. Read safety rules and instructions.<br>**Writing.** Write reports and essays with proper format, punctuation, spelling, and grammar, using all parts of speech.<br>**Speaking.** Speak before an audience with poise, voice control, and confidence, using correct English and a well-modulated voice. |

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* It was necessary at times to update and/or modify the Department of Labor information in order to reflect new employment conditions and the realities of training. However, the basic organization and intent of the system developed by the Department of Labor and reflected in the *Dictionary of Occupational Titles* has been carefully followed. Critical commentary dealing with the development and utilization of the D.O.T. documents points to certain unavoidable limitations, as well as to strengths. An intent to avoid the former and take advantage of the latter underlies the development of the guide and accounts for the modifications of this information.

## Specific Vocational Preparation (SVP) Requirements

**Level 6:** Possesses training over one year up to and including two years so as to perform assigned duties in the organization, to gain knowledge and experience for promotion to next level positions. Observes techniques utilized by experienced workers, learns line and staff functions of each department, and becomes familiar with management policies and viewpoints as they affect each phase of operations.

## Aptitude (APT) Requirements

| | |
|---|---|
| **Intelligence (G), Level 3 Capability:** | General learning ability. The ability to "catch on" or understand instructions and underlying principles; the ability to reason and make judgments. Closely related to doing well in school. |
| **Motor Coordination (K), Level 2 Capability:** | Ability to coordinate eyes and hands or fingers rapidly and accurately in making precise movements with speed. Ability to make a movement response accurately and quickly. |
| **Manual Dexterity (M), Level 3 Capability:** | Ability to move the hands easily and skillfully. Ability to work with the hands in placing and turning motions. |
| **Eye-Hand-Foot Coordination, Level 3 Capability:** | Ability to move the hand and foot coordinately with each other in accordance with visual stimuli. |

## Interest (INT) Requirements

| | | |
|---|---|---|
| **Factor 1:** Situations involving activities dealing with things and objects. | is preferred over | **Factor 6:** Situations involving activities concerned with people and the communication of ideas. |
| **Factor 7:** Situations involving activities of a scientific and technical nature. | is preferred over | **Factor 2:** Situations involving activities of business contact with people. |
| **Factor 9:** Situations involving activities that are nonsocial in nature, and are carried on in relation to processes, machines, and techniques. | is preferred over | **Factor 4:** Situations involving working with people for their presumed good, as in the social welfare sense, or dealing with people and language in social situations. |

## Temperaments (TEMP) Requirements

**Situation Type 8:** Situations involving performing adequately under stress when confronted with the critical or unexpected or when taking risks.

**Situation Type 9:** Situations involving the evaluation (arriving at generalizations, judgments, or decisions) of information against sensory or judgmental criteria.

**Situation Type Y:** Situations involving the precise attainment of set limits, tolerances, or standards.

## Physical Demands

Very heavy physical demands associated with:

**Factor 2:** Climbing and/or Balancing
**Factor 3:** Stooping, Kneeling, Crouching, and/or Crawling
**Factor 4:** Reaching, Handling, Fingering, and/or Feeling
**Factor 5:** Talking and/or Hearing
**Factor 6:** Seeing

## Working Conditions

Work is performed both inside and outside under these conditions:

**Condition 3:** Extremes of Heat Plus Temperature Changes
**Condition 4:** Wet and Humid
**Condition 5:** Noise and Vibration
**Condition 6:** Hazards
**Condition 7:** Fumes, Odors, Toxic Conditions, Dust, and Poor Ventilation

# SECTION 2.4

## The Advanced General Education Program

The Advanced General Education Program is designed to teach an individual the information, concepts, and general knowledge required to pass the American Council on Education's High School General Education Development (GED) Test. All students who enter a training program with, or who subsequently attain, qualifying scores on the Advanced Stanford Achievement Test should be encouraged to enter and complete this program if they do not have the prerequisite GED level required for effective performance in the training program. See Section 2.2 for information on determining the GED (General Educational Development) level of students.

The Advanced General Education Program provides comprehensive self-instruction in each of the following areas: correctness and effectiveness of expression, interpretation of literary materials, social studies, natural sciences, and general mathematics.

It should be stressed that the program is very comprehensive and will meet the learning needs of the vast majority of students who qualify for participation (those who have a sixth-grade mathematics and a sixth-grade reading ability as a minimum).

The program has been designed to require little routine teacher attention. Instructions for placement of materials are included in a teacher's manual along with detailed administrative directions. Once students have become familiar with this placement and with the procedures for taking the lessons and grading their own mastery tests, instructor assistance should be required only when students encounter difficulties they cannot themselves resolve and when progress is to be recorded.

The curriculum of the Advanced General Education Program is designed to provide the student with an educational background equivalent to that obtained in the typical high school course of studies, on which the standard high school achievement tests are based.

Emphasis in training is placed on learning concepts, rather than on the test-taking skills which are taught incidentally. The program prepares the student by improving his or her reading ability, increasing vocabulary, providing experience at interpretive tasks, and making him or her broadly familiar with the subject areas covered by the curriculum.

Flexible administration of the program has been accomplished in two primary ways: (1) lesson units do not take more than an hour to complete and (2) periodic screening tests enable the student to either by-pass material he or she may already know or to repeat materials that he or she did not learn sufficiently well. The time required to complete all of the lesson materials in the Advanced General Education Program averages 145 hours with a range of 90 to 230 hours.

Below is a complete listing of program materials in the Advanced General Education Program, which can be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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* This section has been excerpted from "Advanced General Education Development—A High School Self-Study Program," U.S. Dept. of Labor, Manpower Administration, Job Corps.

## TEACHER'S ADMINISTRATIVE MATERIALS

Teacher's Manual
Teacher's Answer Key
Progress Flow Chart

## STUDENTS' INTRODUCTORY AND SELF-ADMINISTERED TEST MATERIALS

Student's Handbook
Screening Tests
Unit Tests
Students' Answer Keys

## SEQUENCE OF LESSONS IN ADVANCED GENERAL EDUCATION PROGRAM

### Level I

Unit 1: Word Roots, Prefixes, Suffixes
Word Context Clues

Unit 2: Map Reading Skills
Climate
Studying Man and the Natural World
Man and His Culture
Reading for Implied Meanings

Unit 3: Production and Consumption
Forms of Government
Reading for Facts, Opinions, and Issues

Unit 4: Basic Economic Systems
Representative Democracy and Political Parties
Reading to Draw Inferences

Unit 5: Craftsmanship and Technology
Government Separation of Powers
Comparisons in Literature

Unit 6: Positive and Negative Numbers
States of Matter: Solid, Liquid, Gas
Properties and Measures of Matter
Energy, Matter, Theory and Law
The Particles and Structure of Matter

Unit 7: Atomic Structure and Chemical Change
Chemical Compounds
Forms of Energy

Unit 8: Solving Fraction Word Problems
Solving Decimal Word Problems
Solving Percentage Word Problems

## Level II

Unit 1: Tables and Graphs
Line Graphs

Unit 2: U.S. Colonization to Independence
U.S. Confederation to Constitutional Convention
Framing the U.S. Constitution
Founding Fathers
The Election Process
The Civil War

Unit 3: Industrialization and Growth of the Cities
Immigration
Unions and Management

Unit 4: Reading for Feelings
Reading for Shifts in Feeling
Reading for Character
Reading for Signs of Hidden Character

Unit 5: Words that Paint Pictures
Devices Used in Literature
The Meaning of Literary Devices
Periods and Levels of Writing
Qualities of Good and Bad Writing

Unit 6: What to Look for in Narrative Writing
Interpreting Figurative Writing
Keeping Track of the Subject in Writing
Reading Literature for Understanding

Unit 7: Life Functions and Cells
Cell Structure
Tissues, Organs, Systems
Growth and Nutrition
Metabolism

Unit 8: Algebra
Powers and Roots
Geometry
Number Series

Unit 9: Speed, Acceleration, and Velocity
Force, Mass, and Distance
Types of Motion and Rest
Electricity and Magnetism
Electrical, Magnetic, and Gravitational Fields
The Conservation and Conversion of Energy
Simple Machines and Work
Gas Laws
Principles of Heat Engines
Sound and Sound Waves
Light Waves and Particles
The Behavior of Light Rays

Unit 10: Atomic Structure and Valence
Chemical Bonding
The Table of Elements
Electrolysis
Osmosis

## Level III

Unit 1: Free Enterprise and Government Regulation
Social Legislation
Taxes

Unit 2: Free Trade and Tariffs
Capitalism, Communism, Socialism
Nationalism vs. Internationalism

Unit 3: Plants and Photosynthesis
The Human Digestive System
Functions of the Blood
Human Circulation and Respiration
Reproduction of a Single Cell
Reproduction by Male and Female Cells
The Human Reproductive System
Genetics and Heredity
The Nervous System
The Glandular System

Unit 4: Difficult Words to Spell
Sentences and Their Parts
Adjectives and Adverbs
Comparative Forms
Spelling ie and ei Words
Using Negatives Correctly
Using Prepositions and Prepositional Phrases
Spelling ance and ence Words
Subject and Object Pronouns
Possessive and Reflexive Pronouns
Possessive and Plural Nouns
Spelling Confusing Word Pairs
Subject and Verb Agreement
Past Verb Forms
Spelling More Difficult Words

Unit 5: Spelling Endings Added to e
Capitalization
Question Marks and Exclamation Points
Quotation Marks
Spelling Double Letter Demons
Colons and Dashes
Punctuating Series with Commas and Semicolons
More Confusing Word Pairs
Separating Sentence Parts with Punctuation
Other Uses for Commas and Semicolons
More Special Spelling Problems

Unit 6: Spelling More Endings
Matching Sentence Parts
Using the Right Sentence Connectives
More Ways to Make Sentences Effective
Last of the Confusing Word Pairs

# SECTION 2.5

## Worker Trait Codification System

Worker traits can be defined as those abilities, personal traits, and individual characteristics required for a worker to achieve average successful job performance. This section provides detailed explanations of these worker traits and their levels: General Educational Development, Specific Vocational Preparation, Aptitudes, Interests, Temperaments, and Physical Demands.

This section also provides an explanation of the last three digits of the occupational code numbers used in the Dictionary of Occupational Titles: namely, the relationship of any particular job to Data, People, and Things. All of the information in Section 2.5 has been excerpted from Appendices A and B of the Dictionary of Occupational Titles, Volume II.

### GENERAL EDUCATIONAL DEVELOPMENT (GED)

General Educational Development embraces the aspects of education, both formal and informal, which contribute to the worker's reasoning development, ability to follow instructions, and acquisition of "tool" knowledges such as language and mathematical skills. It is education of a general nature which does not have a recognized, fairly specific, occupational objective. Ordinarily such education is obtained in elementary school, high school, or college. It also derives from experience and from individual study. The table on the next page explains the various levels of General Educational Development.

### SPECIFIC VOCATIONAL PREPARATION (SVP)

Specific Vocational Preparation includes the amount of time required to learn the techniques, acquire the information, and develop the facility needed for average performance in a specific job-worker situation. This training may be acquired in a school, work, military, institutional, or avocational environment. It does not include the orientation training required of every fully qualified worker to become accustomed to the special conditions of any new job. Specific Vocational Preparation includes training given in any of the following circumstances:

- vocational education such as high school commercial or shop training, technical school, art school, and that part of college training which is organized around a specific vocational objective.
- apprentice training, for apprenticeable jobs only.
- in-plant training given by an employer in the form of organized classroom study.
- on-the-job training under the instruction of a qualified worker.
- essential experience in other, less responsible jobs which lead to the higher-level job, or serving in other jobs which qualify.

## GENERAL EDUCATIONAL DEVELOPMENT

| Level | Reasoning Development | Mathematical Development | Language Development |
|---|---|---|---|
| 6 | Apply principles of logical or scientific thinking to a wide range of intellectual and practical problems. Deal with non-verbal symbolism (formulas, scientific equations, musical notes, graphs, etc.) in its most difficult phases. Deal with a variety of abstract and concrete variables. Apprehend the most abstruse classes of concepts. | Apply knowledge of advanced mathematical and statistical techniques such as differential and integral calculus, factor analysis, and probability determination, or work with a wide variety of theoretical mathematical concepts and make original applications of mathematical procedures, as in empirical and differential equations. | Comprehension and expression of a level to:<br>• Report, write, or edit articles for such publications as newspapers, magazines, and technical or scientific journals.<br>• Prepare and deliver lectures on politics, economics, education, or science.<br>• Interview, counsel, or advise such people as students, clients, or patients in such matters as welfare eligibility, vocational rehabilitation, mental hygiene, or marital relations. |
| 5 | Apply principles of logical or scientific thinking to define problems, collect data, establish facts, and draw conclusions. Interpret an extensive variety of technical instructions in books, manuals, and mathematical or diagrammatic form. Deal with several abstract and concrete variables. | | |
| 4 | Apply principles of rational systems to solve practical problems and deal with a variety of concrete variables in situations where only limited standardization exists. Interpret a variety of instructions furnished in written, oral, diagrammatic, or schedule form. | Perform ordinary arithmetic, algebraic and geometric procedures in standard, practical applications. | Comprehension and expression of a level to:<br>• Transcribe dictation, make appointments for executive and handle personal mail, interview and screen people, and write routine correspondence on own initiative.<br>• Interview job applicants to determine work best suited for their abilities and experience, and contact employers to interest them in services of agency.<br>• Interpret technical manuals as well as drawings and specifications, such as layouts, blueprints, and schematics. |
| 3 | Apply common sense understanding to carry out instructions furnished in written, oral, or diagrammatic form. Deal with problems involving several concrete variables in or from standardized situations. | Make arithmetic calculations, involving fractions, decimals, and percentages. | Comprehension and expression of a level to:<br>• File, post, and mail such material as forms, checks, receipts, and bills.<br>• Copy data from one record to another, fill in report forms, and type all work from rough draft or corrected copy.<br>• Interview members of household to obtain such information as age, occupation, and number of children, to be used as data for surveys or economic studies.<br>• Guide people on tours through historical or public buildings, describing such features as size, value, and points of interest. |
| 2 | Apply common sense understanding to carry out detailed but uninvolved written or oral instructions. Deal with problems involving a few concrete variables in or from standardized situations. | Use arithmetic to add, subtract, multiply, and divide whole numbers. | |
| 1 | Apply common sense understanding to carry out simple one- or two-step instructions. Deal with standardized situations with occasional or no variables in or from these situations encountered on the job. | Perform simple addition and subtraction, reading and copying of figures, or counting and recording. | Comprehension and expression of a level to:<br>• Learn job duties from oral instructions or demonstration.<br>• Write identifying information, such as name and address of customer, weight, number, or type of product, on tags or slips.<br>• Request orally or in writing such supplies as linen, soap, or work materials. |

The following table describes the nine levels of Specific Vocational Preparation:

| Level | Time |
|---|---|
| 1 | Short demonstration only |
| 2 | Anything beyond short demonstration up to and including 30 days |
| 3 | Over 30 days up to and including three months |
| 4 | Over three months up to and including six months |
| 5 | Over six months up to and including one year |
| 6 | Over one year up to and including two years |
| 7 | Over two years up to and including four years |
| 8 | Over four years up to and including 10 years |
| 9 | Over 10 years |

## APTITUDES (APT)

The five-point scale below indicates how much of each aptitude the job requires for satisfactory or average performance. The average requirements, rather than a maximum or minimum, are cited. The amount required is expressed in terms of equivalent amounts possessed by segments of the general working population. The five-point scale is as follows:

1 = The top 10 percent of the population. This segment of the population possesses an extremely high degree of the aptitude.

2 = The highest third exclusive of the top 10 percent of the population. This segment of the population possesses an above-average or high degree of the aptitude.

3 = The middle third of the population. This segment of the population possesses a medium degree of the aptitude, ranging from slightly above to slightly below average.

4 = The lowest third exclusive of the bottom 10 percent of the population. This segment of the population possesses a below-average or low degree of the aptitude.

5 = The lowest 10 percent of the population. This segment of the population possesses a negligible degree of the aptitude.

This scale can be applied to each of the 11 aptitudes below to indicate the amount required for a particular job or task. The code letters used to designate each aptitude are in parentheses.

## DESCRIPTION OF APTITUDES

**Intelligence (G):** General learning ability. The ability to "catch on" or understand instructions and underlying principles. Ability to reason and make judgments. Closely related to doing well in school.

**Verbal (V):** Ability to understand meanings of words and ideas associated with them, and to use them effectively. Ability to comprehend language, to understand relationships between words, and to understand meanings of whole sentences and paragraphs. Ability to present information or ideas clearly.

**Numerical (N):** Ability to perform arithmetic operations quickly and accurately.

**Spatial (S):** Ability to comprehend forms in space and understand relationships of plane and solid objects. May be used in such tasks as blueprint reading and in solving geometry problems. Frequently described as the ability to "visualize" objects of two or three dimensions, or to think visually of geometric forms.

**Form Perception (P):** Ability to perceive pertinent detail in objects or in pictorial or graphic material. Ability to make visual comparisons and discriminations and see slight differences in shapes and shadings of figures and widths and lengths of lines.

**Clerical Perception (Q):** Ability to perceive pertinent detail in verbal or tabular material. Ability to observe differences in copy, to proofread words and numbers, and to avoid perceptual errors in arithmetic computation.

**Motor Coordination (K):** Ability to coordinate eyes and hands or fingers rapidly and accurately in making precise movements with speed. Ability to make a movement response accurately and quickly.

**Finger Dexterity (F):** Ability to move the fingers and to manipulate small objects with the fingers rapidly or accurately.

**Manual Dexterity (M):** Ability to move the hands easily and skillfully. Ability to work with the hands in placing and turning motions.

**Eye-Hand-Foot Coordination (E):** Ability to move the hand and foot coordinately with each other in accordance with visual stimuli.

**Color Discrimination (C):** Ability to perceive or recognize similarities or differences in colors, or in shades or other values of the same color. Ability to identify a particular color, or to recognize harmonious or contrasting color combinations, or to match colors accurately.

## INTERESTS (INT)

This worker trait component involves preferences for certain types of work activities or experiences, with accompanying rejection of contrary types of activities or experiences. Five pairs of interest factors are provided so that a positive preference for one factor of a pair also implies rejection of the other factor of that pair.

| | | | | |
|---|---|---|---|---|
| 1 | Situations involving a preference for activities dealing with things and objects. | vs. | 6 | Situations involving a preference for activities concerned with people and the communication of ideas. |

|  |  |  |  |  |
|---|---|---|---|---|
| 2 | Situations involving a preference for activities involving business contact with people. | vs. | 7 | Situations involving a preference for activities of a scientific and technical nature. |
| 3 | Situations involving a preference for activities of a routine, concrete, organized nature. | vs. | 8 | Situations involving a preference for activities of an abstract and creative nature. |
| 4 | Situations involving a preference for working with people for their presumed good, as in the social welfare sense, or for dealing with people and language in social situations. | vs. | 9 | Situations involving a preference for activities that are nonsocial in nature, and are carried on in relation to processes, machines, and techniques. |
| 5 | Situations involving a preference for activities resulting in prestige or the esteem of others. | vs. | 0 | Situations involving a preference for activities resulting in tangible, productive satisfaction. |

## TEMPERAMENTS (TEMP)

Temperaments refer to different types of occupational situations to which workers must adjust.

1 Situations involving a variety of duties often characterized by frequent change.

2 Situations involving repetitive or short cycle operations carried out according to set procedures or sequences.

3 Situations involving doing things only under specific instruction, allowing little or no room for independent action or judgment in working out job problems.

4 Situations involving the direction, control, and planning of an entire activity or the activities of others.

5 Situations involving the necessity of dealing with people in actual job duties beyond giving and receiving instructions.

6 Situations involving working alone and apart in physical isolation from others, although the activity may be integrated with that of others.

7 Situations involving influencing people in their opinions, attitudes, or judgments about ideas or things.

8 Situations involving performing adequately under stress when confronted with the critical or unexpected or when taking risks.

9 Situations involving the evaluation (arriving at generalizations, judgments, or decisions) of information against sensory or judgmental criteria.

0 Situations involving the evaluation (arriving at generalizations, judgments, or decisions) of information against measurable or verifiable criteria.

X Situations involving the interpretation of feelings, ideas, or facts in terms of personal viewpoint.

Y Situations involving the precise attainment of set limits, tolerances, or standards.

# PHYSICAL DEMANDS (PHYS DEM)

Physical demands are those physical activities required of a worker in a job. The physical demands referred to serve as a means of expressing both the physical requirements of the job and the physical capacities (specific physical traits) a worker must have to meet the requirements. For example, "seeing" is the name of a physical demand required by many jobs (perceiving by the sense of vision), and also the name of a specific capacity possessed by many people (having the power of sight). The worker must possess physical capacities at least in an amount equal to the physical demands made by the job.

## FACTOR 1: Lifting, Carrying, Pushing, and/or Pulling (Strength)

These are the primary "strength" physical requirements, and generally speaking, a person who engages in one of these activities can engage in all. Specifically, each of these activities can be described as:

Lifting: Raising or lowering an object from one level to another (includes upward pulling).

Carrying: Transporting an object, usually holding it in the hands or arms or on the shoulder.

Pushing: Exerting force upon an object so that the object moves away from the force (includes slapping, striking, kicking, and treadle actions).

Pulling: Exerting force upon an object so that the object moves toward the force (includes jerking).

The five degrees of Factor 1: Lifting, Carrying, Pushing, and/or Pulling are as follows:

Sedentary Work (S) = Lifting 10 lbs. maximum and occasionally lifting and/or carrying such articles as dockets, ledgers, and small tools. Although a sedentary job is defined as one which involves sitting, a certain amount of walking and standing is often necessary in carrying out job duties. Jobs are sedentary if walking and standing are required only occasionally and other sedentary criteria are met.

Light Work (L) = Lifting 20 lbs. maximum with frequent lifting and/or carrying of objects weighing up to 10 lbs. Even though the weight lifted may be only a negligible amount, a job is in this category when it requires walking or standing to a significant degree, or when it involves sitting most of the time with a degree of pushing and pulling of arm and/or leg controls.

Medium Work (M) = Lifting 50 lbs. maximum with frequent lifting and/or carrying of objects weighing up to 25 lbs.

Heavy Work (H) = Lifting 100 lbs. maximum with frequent lifting and/or carrying of objects weighing up to 50 lbs.

Very Heavy Work (V) = Lifting objects in excess of 100 lbs. with frequent lifting and/or carrying of objects weighing 50 lbs. or more.

## FACTOR 2: Climbing and/or Balancing

Climbing: Ascending or descending ladders, stairs, scaffolding, ramps, poles, ropes, and the like, using the feet and legs and/or hands and arms.

Balancing: Maintaining body equilibrium to prevent falling when walking, standing, crouching, or running on narrow, slippery, or erratically moving surfaces; or maintaining body equilibrium when performing gymnastic feats.

## FACTOR 3: Stooping, Kneeling, Crouching, and/or Crawling

Stooping: Bending the body downward and forward by bending the spine at the waist.

Kneeling: Bending the legs at the knees to come to rest on the knee or knees.

Crouching: Bending the body downward and forward by bending the legs and spine.

Crawling: Moving about on the hands and knees or hands and feet.

## FACTOR 4: Reaching, Handling, Fingering, and/or Feeling

Reaching: Extending the hands and arms in any direction.

Handling: Seizing, holding, grasping, turning, or otherwise working with the hand or hands (fingering not involved).

Fingering: Picking, pinching, or otherwise working with the fingers primarily (rather than with the whole hand or arm as in handling).

Feeling: Perceiving such attributes of objects and materials as size, shape, temperature, or texture, by means of receptors in the skin, particularly those of the fingertips.

## FACTOR 5: Talking and/or Hearing

Talking: Expressing or exchanging ideas by means of the spoken word.

Hearing: Perceiving nature of sounds by the ear.

## FACTOR 6: Seeing

Obtaining impressions through the eyes of the shape, size, distance, motion, color, or other characteristics of objects. The major visual functions are defined as follows:

Acuity, Far: Clarity of vision at 20 feet or more.

Acuity, Near: Clarity of vision at 20 inches or less.

Depth Perception: Three-dimensional vision. The ability to judge distance and space relationships so as to see objects where and as they actually are.

Field of Vision: The area that can be seen up and down or to the right or left while the eyes are fixed on a given point.

Accommodation: Adjustment of the lens of the eye to bring an object into sharp focus. This item is especially important when doing near-point work at varying distances from the eye.

Color Vision: The ability to identify and distinguish colors.

## DATA, PEOPLE, AND THINGS

The last three digits of an occupational code number express the job's relationship to Data, People, and Things. Only relationships which are significant in terms of job requirements are reflected in the code numbers. The incidental relationships which every worker has to Data, People, and Things, but which do not seriously affect successful performance of the essential duties of the job, are not reflected. Each successive relationship includes those that are simpler.

| **DATA** (4th digit) | **PEOPLE** (5th digit) | **THINGS** (6th digit) |
|---|---|---|
| 0 Synthesizing | 0 Mentoring | 0 Setting Up |
| 1 Coordinating | 1 Negotiating | 1 Precision Working |
| 2 Analyzing | 2 Instructing | 2 Operating-Controlling |
| 3 Compiling | 3 Supervising | 3 Driving-Operating |
| 4 Computing | 4 Diverting | 4 Manipulating |
| 5 Copying | 5 Persuading | 5 Tending |
| 6 Comparing | 6 Speaking-Signalling | 6 Feeding-Offbearing |
| 7 No significant relationship | 7 Serving | 7 Handling |
| 8 No significant relationship | 8 No significant relationship | 8 No significant relationship |

# SECTION 2.6

## Related Jobs at Entry, Intermediate, and Advanced Levels

This section is intended primarily for use in career guidance activities. Persons trained as fire cadets will acquire skills and knowledge which provide job and career mobility across a broad range of occupations. The following list of job descriptions, as a partial compilation, illustrates the career flexibility possible given continued training or a minimum amount of retraining.

To be used effectively, this list should be matched against the Inventory of Job Tasks (Section 1.4), which has been structured by job levels (entry, intermediate, and advanced) within the career ladder. Guidance counselors, instructors and students, as well as employers, recruiting officers, placement and personnel directors, and others within education and industry should find these products of much value. The job titles and code numbers have been drawn from the Dictionary of Occupational Titles, where a complete listing of related jobs can be found.

ALARM INVESTIGATOR **(any industry)**
D.O.T. 376.868

Investigates source of alarm and trouble signals on subscribers' premises, as recorded in central station of electrical protective signaling system. Drives radio-equipped car to subscriber's establishment, and locates source of alarm. Investigates disturbances, such as unlawful intrusion, fires, and property damage. Apprehends unauthorized persons found on property, using armed force if necessary, and releases them to custody of authorities. Contacts supervisor by radio or telephone to report irregularities and obtain further instructions. Adjusts and repairs subscriber's signaling equipment to restore service, using electrician's handtools. Coordinates activities with police and fire departments during alarms. Writes investigation and automobile usage reports.

ALARM OPERATOR **(government service)**
D.O.T. 379.168

Operates municipal fire alarm system, radio transmitter and receiver, and telephone switchboard. Receives incoming fire calls by telephone or through alarm system. Questions caller, observes alarm register that codes location of fire, and scans map of city to determine whether fire is located within area served by city fire department. Notifies fire station, using radio, and starts alarm system that automatically contacts all fire stations and indicates location of fire. Relays messages from scene of fire, such as requests for additional help and medical assistance. Records date, time, type of call and destination of messages received or transmitted.

ALARM-TROUBLE MAN **(business services)**
D.O.T. 823.281

Adjusts, repairs, and tests electrical equipment to maintain burglar and fire alarm systems. Examines protective system prior to installation, using continuity meter. Directs workers' placement of units to provide efficient operation and concealment. Repairs damages on installed system due to accident, break-in, fire, or other causes.

BATTALION CHIEF **(government service)**
D.O.T. 373.168

Supervises and coordinates firefighting activities of battalion of fire companies in municipality. Determines plan of action of fire companies for answering calls in fire salvage and rescue operations. Directs inspections of commercial buildings to insure compliance with fire and safety regulations. Determines cause of fire and appraises amount of fire loss to building and other property. Directs investigation of causes of incendiary and arson cases. Promotes fire prevention activities by organizing and training fire brigades in industrial plants. Plans for purchase of new equipment and use of new techniques in rescue, first aid, and firefighting operations. Directs personnel in use of firefighting equipment. Inspects fire stations, equipment, personnel, and records of assigned companies to insure efficiency and enforcement of departmental regulations. Recommends awards for officers and men for superior service. Prepares reports of accidents involving equipment and personnel. Keeps equipment and personnel records. May train civil defense workers.

**COMPLIANCE INVESTIGATOR (government service) D.O.T. 168.168**

Investigates business establishments and individuals to settle claims or insure compliance with state and federal laws and regulations, such as those governing child labor, wages and hours, and financial responsibility. Interviews persons, observes environmental conditions, and examines records, such as financial statements, payrolls, correspondence, and school grade-transcripts, to obtain or verify information and determine individual's or firm's responsibility under law. Explains liabilities and responsibilities and advises persons involved in corrective or compliance procedures. Prepares reports of investigations for administrative or legal departments. May make determinations and judgments and settle claims.

**FIRE ASSISTANT (government service)**
**D.O.T. 169.168**

Advises local governments, public, and timber interests on prevention and control of forest fires. Inspects forest areas and standby firefighting equipment to detect deficiencies in fire prevention and control programs. Prepares public-information materials and campaigns on fire prevention techniques. Gives instructions to firefighting crews in methods of controlling forest fires, considering such factors as terrain, wind conditions, history of rainfall in fire area, and location of population centers. Gives public lectures to campers, youth groups, and hunters to promote responsible use of fire and inflammable materials in forest areas. May direct activities of fire suppression crews. May participate in fighting fires.

**FIRE BOSS (mining and quarrying)**
**D.O.T. 939.387**

Inspects underground mines for presence of fire hazards, toxic gas, and inadequate ventilation. Tours shafts, haulageways, and working areas to detect gas, excessive combustible dust, and inadequate ventilation, using safety lamp, methane and carbon monoxide detectors, and anemometer. Replaces torn ventilation partitions and opens and closes doors to restore planned ventilation. Reports presence of hazardous conditions. Compiles log of accidents, explosions, and fires if required by state mining authorities. May conduct or participate in safety drills and meetings. May assist in rescue operations.

**FIRE CAPTAIN (government service)**
**D.O.T. 373.168**

Supervises and coordinates activities of company of firefighters assigned to specific firehouse. Inspects station house, buildings, grounds, and facilities. Examines firetrucks and equipment, such as ladders and hoses, to insure compliance with departmental maintenance standards. Responds to fire alarms and determines, from observation, nature and extent of fire, condition of building, danger to adjacent buildings, and source of water supply, and directs firefighting crews accordingly. Trains subordinates in use of equipment and methods of extinguishing all types of fires. Evaluates efficiency of personnel. Inspects commercial establishments in assigned district and reports fire hazards or safety violations to fire inspector. Compiles report of each fire call, listing location, type, probable cause, estimated damage, and disposition. May respond to emergency calls to render first aid. May recommend corrective measures for fire hazards or safety violations to building owners.

### FIRE CHIEF (government service)
### D.O.T. 373.118

Supervises personnel and coordinates activities of municipal fire department. Directs training of personnel and administers laws and regulations affecting department. Evaluates fire prevention and fire control policies by keeping abreast of new methods and conducting studies of departmental operations. Assumes personal command at multiple-alarm fires. Supervises personnel engaged in operation and maintenance of fire stations and equipment. Coordinates mutual fire protection plans with surrounding municipalities. Surveys buildings, grounds, and equipment to estimate needs of department and prepare departmental budget. Confers with officials and community groups and conducts public relations campaigns to present need for changes in laws and policies and to encourage fire prevention. May investigate causes of fires and inspect buildings for fire hazards. May control issuance of occupancy permits and similar licenses. In smaller communities may perform duties of battalion chief.

### FIRE CHIEF (sawmill)
### D.O.T. 373.168

Supervises and coordinates activities of firefighting personnel in large sawmill. Buys and inspects fire-prevention and firefighting equipment, such as sprinkler systems, fire extinguishers, and hose. Supervises day and night watchmen, gatemen, and firemen.

### FIRE EQUIPMENT MAN (any industry)
### D.O.T. 739.484

Inspects, tests, and repairs conduits and firefighting equipment to secure property against fires. Turns valves to force water through lines to test them for leaks, breaks, and stoppage. Replaces and repairs defective sections of hoses and pipelines, using handtools. Inserts wire rod in hose of fire extinguishers to remove stoppages. Tests and cleans fire extinguishers and recharges them with solvents, sulfuric acid, carbon tetrachloride, and other chemicals. Maintains inventory of equipment and fills out inspection tags and reports. Reports unsatisfactory conditions to fire marshal. May repair gas masks. May service and drive firetruck. May test for presence of gases, using gas scope or explosive meter.

### FIRE EQUIPMENT MAN HELPER
### (any industry) D.O.T. 739.887

Assists fire equipment man in testing, inspecting, and repairing firefighting equipment.

### FIRE EXTINGUISHER SERVICEMAN
### (any industry) D.O.T. 709.884

Repairs and tests fire extinguishers in repair shops and in establishments, such as factories, homes, garages, and office buildings, using handtools and hydrostatic test equipment. Dismantles extinguisher and examines tubings, horns, head gaskets, cutter discs, and other parts for defects. Replaces worn or damaged parts, using handtools. Cleans extinguishers and recharges them with materials, such as soda water and sulfuric acid, carbon tetrachloride, nitrogen, or patented solutions. Tests extinguishers for conformity with legal specifications, using hydrostatic test equipment. May install cabinets and brackets to hold extinguishers.

### FIREFIGHTER, CRASH (air transportation)
### D.O.T. 373.884

Responds to actual or potential air-crash emergencies to prevent or extinguish fires and rescue plane crew, working as member of rescue squad. Drives to scene of crash or to end of runway where disabled craft is expected to land. Sprays chemical foam onto runway surface to minimize danger of explosion on impact, and water fog or chemical agents onto craft after landing. Participates in removal of trapped or injured crew members, using flame-cutting equipment if necessary to gain entry to damaged craft. Participates in removal or neutralization of explosive ordnance material where military aircraft attempt landing at civilian airport. Renders first aid to injured. Establishes and mans firelines to prevent unauthorized persons from entering crash area.

### FIREFIGHTING EQUIPMENT SPECIALIST (government service) D.O.T. 620.381

Visits locations to repair and evaluate condition of firefighting vehicles, equipment, buildings, and structures. Inspects equipment to determine its condition. Performs minor repairs on vehicles or equipment, or requests repair or reconditioning. Orders replacement parts. Performs minor electrical or plumbing repairs to buildings. Estimates cost of repairs. Keeps records of all repairs and cost.

### FIRE INSPECTOR (any industry)
### D.O.T. 379.387

Inspects premises of an industrial plant to detect and eliminate fire hazards. Inspects fire extinguishing and fire protection equipment to insure they are operable and prepares reports listing repairs and replacements needed. Patrols plant areas and notes and investigates any unsafe conditions and practices which might cause or increase fire hazards. Reports findings to fire marshal with recommendations for eliminating or counteracting hazards. Renders first aid in emergencies. Patrols plant areas in which raw and combustible materials are stored, takes temperature and pressure readings from instruments, and reports undesirable conditions or takes steps to correct such conditions. May perform tests on fire prevention equipment in plants where explosive or inflammable materials are processed. May participate in fighting fires.

### FIRE INSPECTOR (government service)
### D.O.T. 373.168

Inspects buildings to detect fire hazards and enforce local ordinances and state laws. Examines interiors and exteriors of buildings to detect hazardous conditions or violations of fire ordinances and laws. Prepares report of violations or unsafe conditions. Discusses condition with owner or manager and recommends safe methods of storing inflammables or other hazardous materials. Informs owner or manager of conditions requiring correction, such as faulty wiring. Issues summons for fire hazards not corrected on subsequent inspection, and enforces code when owner refuses to cooperate. Keeps file of inspection records and prepares monthly report of activities. May perform duties of firefighter or fire captain.

### FIRE LOOKOUT (government service)
### D.O.T. 441.168

Observes, locates, and reports forest fires and weather phenomena from remote fire-lookout station. Maintains surveillance from station to observe fires, weather conditions, and unusual events, and to report them to base camp by radio or telephone. Locates fires on area map, using azimuth sighter and known landmarks, estimates size and characteristics of fire, and reports findings. Observes instruments and reports daily meteorological data, such as temperature, relative humidity, wind velocity, and cloud formations. Receives and relays messages from base camp, mobile units, and law enforcement and governmental agencies relating to weather forecasts, fire hazard conditions, emergencies, accidents, and location of crews and personnel. Serves as public contact at station and promotes fire prevention program by explaining state and federal laws, timber company policies, hazard fire conditions, and fire prevention methods. Maintains records and log books, and makes adjustments to radios and firefinding equipment. May suppress fires near lookout station.

### FIREMAN, STAGE (amusement and recreation)
### D.O.T. 379.387

Inspects premises of theaters to detect and eliminate fire hazards and examines safety equipment backstage in theaters to determine efficiency.

Scrutinizes firefighting and fire prevention equipment, such as sprinkler systems, fire extinguishers, and asbestos curtains, to insure operating efficiency. Inspects theater during performance to prevent unsafe conditions, such as overcrowding, blocked exits, and crowded aisles. Examines flameproofing of stage sets, scenery, curtain, drops, and draperies to eliminate or counteract fire hazards. Watches stage presentations for compliance with safety rules and local fire ordinances.

### FIRE MARSHAL (any industry)
### D.O.T. 373.168

Supervises and coordinates activities of firefighting personnel of industrial establishment and inspects equipment and premises to insure adherence to fire regulations. Inspects and orders replacement or servicing of firefighting equipment, such as sprinklers and extinguishers. Issues permits for storage and use of hazardous or flammable materials. Inspects premises to detect combustion hazards. Orders and directs fire drills. Directs firefighting and rescue activities according to knowledge of accepted procedures.

### FIRE PATROLMAN (government service)
### D.O.T. 441.687

Patrols assigned area of forest to locate and report fires and hazardous conditions, and to insure compliance with fire regulations by travelers and campers. Travels on foot, horseback, or vehicle to vista points to scan for fires and unusual or dangerous conditions. Reports findings and receives and relays emergency calls, using telephone or two-way radio. Visits camping sites in area to inspect activities of campers and insure compliance with forest use and fire regulations. Extinguishes smaller fires with portable extinguisher, shovel, and axe. May serve as crew leader for larger fires. May render assistance or first aid to lost or injured persons. May participate in search for lost travelers or campers. May be stationed at one vantage point except when engaged in fighting fires or investigating unusual conditions elsewhere in forest.

### FIRE PREVENTION RESEARCH ENGINEER (professional and kindred occupations)
### D.O.T. 012.188

Conducts research to determine causes and methods of preventing fires, and prepares educational materials concerning fire prevention for insurance companies. Studies and analyzes reports, statistics, and other data to determine fire causes and losses. Investigates fire hazards in building construction, heating, electrical systems, and occupancy; develops safety measures to overcome them. Advises field personnel to assist them in minimizing fire losses. Prepares instructions and such other materials as posters, films, and articles to prevent fires and minimize fire hazards.

### FIREPROOFING MAN (light, heat, and power)
### D.O.T. 863.884

Wraps electric cables in manholes and transformer vaults with fireproofing materials, such as asbestos. Coats wrapping with fireproofing cement.

### FIRE PROTECTION ENGINEER (professional and kindred occupations) D.O.T. 012.188

Advises and assists private and public organizations and military services for purposes of safeguarding life and property against fire, explosion, and related hazards. Makes studies of industrial, mercantile, and public buildings, homes, and other property before and after construction, considering factors such as fire resistance of construction, usage or contents of buildings, water supplies and water delivery, and egress facilities. Designs or recommends materials or equipment, such as structural components protection, fire detection equipment, alarm systems, and fire extinguishing devices and systems, and advises on location, handling, installation, and maintenance. Recommends materials, methods, or equipment for alleviation of conditions conducive to fire. Devises fire protection programs, and organizes and trains personnel to carry out such programs. May evaluate fire departments and adequacy of laws, ordinances, and regulations affecting fire prevention or fire safety. Conducts research and tests on fire retardants and fire safety of materials and devices. May teach courses on fire prevention and protection at accredited educational institutions. May advise and plan for prevention of destruction by fire, wind, water, or other causes of damage.

### FIRE WARDEN (forestry)
### D.O.T. 441.168

Supervises and coordinates activities of workers engaged in forest fire prevention and control. Examines and inventories firefighting equipment, such as axes, firehose, water buckets, and chemical fire extinguishers, to determine amount and adequacy of equipment. Directs maintenance and repair of equipment, and requisitions additional equipment when necessary. Assigns personnel and equipment to be placed at critical points in case of fire. Inspects forest, logging, and mill areas for fire hazards, and reports hazards to supervisor of area involved. Enforces state and federal fire regulations. Dispatches personnel and equipment to fires, and supervises firefighting crews directly or through subordinates. May be required to restrict public recreational use of forest area during fire season.

### FOREST FIRE FIGHTER (government service)
### D.O.T. 441.887

Suppresses forest fires, working alone or as member of crew. Fells trees, digs trenches, and extinguishes flames and embers to suppress fire, using axe, chainsaw, shovel, and hand or engine-driven pumps. Patrols burned area after fire to watch for hot spots that may restart fire. May cut brush, clear ground litter, and ignite back fire to hasten burnout of major fire within contained area and to prevent its spread across firelines.

### GASMAN (petroleum production)
### D.O.T. 549.782

Operates automatically controlled natural-gas treating unit in oilfield to render gas suitable for fuel and for pipeline transportation. Opens valves to admit gas and specified chemicals into treating vessel where moisture is absorbed and impurities are removed. Adjusts controls of auxiliary equipment, such as pumps, heating coils, and cooling tower. Reads temperature and pressure gages and adjusts controls to keep heat and pressure at level of maximum efficiency within safe operating limits. Performs routine tests or delivers samples to laboratory to determine qualities of gas, such as B.t.u. value, flame candlepower, and specific gravity, and proportions of elements, such as methane, propane, and natural gasoline. Drains samples of boilerwater from treating unit for laboratory analysis. Adds specified chemicals to water to keep heating and cooling systems in working order. May adjust and repair gas meters and governors, using handtools. May change charts on meters equipped with automatic recorders. May advise and assist workers repairing regulators (governors) and other control instruments.

### GASMAN, HEAD (petroleum production; pipelines) D.O.T. 549.131

Supervises and coordinates activities of workers engaged in sampling and testing natural gas, and controlling processing equipment at oilfield installations. Directs workers in inspection of storage tanks, regulators, traps, and dehydration plants. Orders sample taking and field testing to determine specific gravity, vapor and hydrocarbon content, and other properties of gas, and to verify suitability of boilerwater used in gas processing equipment. Revises field maps to show locations of gas processing and control equipment.

### GUARD, CHIEF (any industry)
### D.O.T. 372.168

Supervises and coordinates activities of guard force of establishment, such as industrial plant, department store, or museum. Assigns personnel to posts or patrol, according to size and nature of establishment and indicated protection requirements. Interprets security rules and directs subordinates in their enforcement, such as issuance of security badges, photographing of employees, and safekeeping of forbidden articles carried by visitors. Responds to calls from subordinates to direct activities during fires, storms, riots, or other emergencies. Inspects or directs inspection of premises to test alarm systems, detect safety hazards, and to insure that safety rules are posted and enforced. Examines fire extinguishers and other safety equipment for serviceability. Reports irregularities and hazards to appropriate personnel. Selects and trains subordinates in protective procedures, first aid, fire safety, and other duties. Cooperates with police, fire, and civil defense authorities in problems affecting establishment.

### INVESTIGATOR (any industry)
D.O.T. 205.368

Investigates background and personal characteristics of persons applying for credit, employment, insurance, or adjustments. Interviews former employers, neighbors, and others who know applicant, in person or by telephone, to verify employment record and obtain history of illnesses and moral and social behavior. Reads city directories and public records to verify residence history, convictions and arrests, property ownership, and unpaid taxes of applicant. Obtains credit rating from banks and credit concerns. Compiles detailed reports of findings. May type reports.

### INVESTIGATOR (insurance)
D.O.T. 191.268

Investigates and gathers facts to determine amount of insurance company's liability on claim or action. Examines claim to determine items to be investigated. Corresponds with or interviews doctors and other hospital personnel, witnesses, and claimants to compile all available information. Prepares detailed report of findings.

### SAFETY INSPECTOR (government service)
D.O.T. 168.168

Investigates establishments and other work projects where workers are employed to enforce city, state, or federal regulations regarding health and safety of workers, and reports violations of these laws to authorities. Enforces laws requiring licensing of workers engaged in hazardous occupations. May enforce laws regulating hours of labor.

### SMOKE JUMPER (government service)
D.O.T. 379.884

Parachutes from airplane into inaccessible forest to suppress forest fires. Jumps from airplane near scene of fire, pulls rip cord when clear of plane, and pulls shroud lines to guide direction of fall toward clear landing area. Orients self in relation to fire, using compass and map, and collects supplies and equipment that are dropped by parachute from plane. Ascertains best method for attacking fire and communicates plan to airplane or base camp with two-way radio. Fells trees, digs trenches, and extinguishes flames and embers to suppress fire, using axe, chainsaw, shovel, and hand or engine-driven water or chemical pumps. Prepares detailed written reports of activities and makes suggestions for all phases of parachute jumping, smoke chasing, and firefighting work assignments. Participates in scheduled physical conditioning and project work while not performing regular duties. May work alone or as member of smoke jumping crew, depending on size of fire involved. May pack parachutes. May repair parachutes.

### SPRINKLER (mining and quarrying)
D.O.T. 939.887

Sprays or sprinkles water on dry coal or dust in mine to cause dust to settle to reduce hazard of explosions, using hand sprinkler, sprayer, or water hose. Records sections of mine sprinkled.

### SPRINKLER-FIRE EXTINGUISHER INSPECTOR (any industry) D.O.T. 379.687

Inspects sprinkler valves and hose houses of fire apparatus. Forces wire rods through hose to clean it.

### SUPPRESSION CREW LEADER (government service) D.O.T. 441.137

Supervises and coordinates activities of crew that fells trees, digs trenches, and extinguishes flames and embers to suppress forest fires. Leads crew to area designated on map by fire warden, forester, or other official, and assigns workers to work stations along fireline. Assigns tasks to crew members to prevent overexertion of any one worker. Observes workers to detect signs of fatigue or illness from smoke inhalation and orders those affected to base camp for treatment. Transmits information and receives instructions from base camp or other units, using portable two-way radio. May fight fires as member of crew.

# SECTION 2.7

# Related Jobs by Worker Trait Group

This section is intended primarily for use in career guidance activities. The lists of jobs presented here are categorized according to the principal worker trait group associated with the firefighting career field: .884 (Manipulating). This group is an important component of the qualifications profile and the inventories of job tasks and general knowledge concepts.

Jobs are arranged numerically according to their complete Dictionary of Occupational Titles (D.O.T.) code number. (See Section 2.5 for an explanation of the codification system used in the D.O.T.) The jobs listed may be drawn from any number of three-digit groups within each Occupational Group Arrangement. This section presents only the base and defined related titles. For a complete listing of all undefined, related, and alternate job titles within each Occupational Group Arrangement, the user is directed to the D.O.T.

## WORKER TRAIT GROUP .884:
## MANIPULATING

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| **20** | **Stenography, Typing, Filing, and Related Work** |
| 207. | **Duplicating Machine Work** |
| 207.884 | Duplicating Machine Operator (clerical) |
| **22** | **Material and Production Recording** |
| 223. | **Stock Checking and Related Work** |
| 223.884 | Sample Worker (any industry) |
| 229. | **Material and Production Recording, not elsewhere classified** |
| 229.884 | Chart Changer (clerical) |
| **24** | **Miscellaneous Clerical Work** |
| 240. | **Collecting** |
| 240.884 | Parking Meter Collector (government service) |
| **36** | **Apparel and Furnishings Services** |
| 362. | **Dry Cleaning Service** |
| 362.884 | Dry Cleaner, Hand (cleaning, dyeing, and pressing)<br>Fur Cleaner (cleaning, dyeing, and pressing)<br>Furniture Cleaner (cleaning, dyeing, and pressing)<br>Leather Cleaner (cleaning, dyeing, and pressing) |

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| 37 | **Protective Services** |
| 373. | **Fire Protection Services** |
| 373.884 | Fire Fighter, Crash (air transportation) |
| 379. | **Protective Services, not elsewhere classified** |
| 379.884 | Skin Diver (any industry)<br>Smoke Jumper (government service) |
| 38 | **Building and Related Services** |
| 382. | **Janitorial Service** |
| 382.884 | Janitor (any industry) |
| 389. | **Building and Related Services, not elsewhere classified** |
| 389.884 | Exterminator (any industry) |
| 44 | **Forestry** |
| 449. | **Forestry, not elsewhere classified** |
| 449.884 | Tree Climber (forestry) |
| 46 | **Agricultural Services** |
| 465. | **Blight and Pest Control and Bindweed Eradication** |
| 465.884 | Fumigator, Orchard (agriculture) |
| 50 | **Metal Processing** |
| 502. | **Melting, Pouring, Casting, and Related Work** |
| 502.884 | Blast Furnace Keeper (iron and steel)<br>Mill Helper (nonferrous metal alloys)<br>Steel Pourer (iron and steel) |
| 54 | **Processing, Petroleum and Related Products** |
| 542. | **Distilling, Subliming, and Carbonizing** |
| 542.884 | Furnace Loader (electrical equipment) |
| 55 | **Processing, Chemicals and Related Products** |
| 557. | **Extruding** |
| 557.884 | Extruder Operator Helper (fabricated plastics products; plastics materials)<br>Jet Man (synthetic fibers)<br>Pump Tester (synthetic fibers) |

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| 59 | **Processing, not elsewhere classified** |
| 590. | **Processing Assorted Materials** |
| 590.884 | Processor, Solid Propellant (explosives) |
| 59[illegible] | **Miscellaneous Processing, not elsewhere classified** |
| [illegible]84 | Equipment Cleaner, Hand (any industry) |
|  | Sampler (coke production) |
| 61 | **Metalworking, not elsewhere classified** |
| 610. | **Hammer Forging** |
| 610.884 | Blacksmith Helper (forging) |
| 614. | **Extruding and Drawing** |
| 614.884 | Tester Operator (nonferrous metal alloys) |
| 62 | **Mechanical Repairing** |
| 620. | **Motorized Vehicle and Engineering Equipment Repairing** |
| 620.884 | Automobile Mechanic Helper (automobile service) |
|  | Construction Equipment Mechanic Helper (construction) |
|  | Electric Truck Repairman (any industry) |
|  | Engineering Equipment Mechanic Helper (construction) |
| 622. | **Rail Equipment Repairing** |
| 622.884 | Air Compressor Mechanic (locomotive and car building and repair) |
|  | Switch Repairman (railroad transportation) |
|  | Tank Car Inspector (compressed and liquified gases) |
| 630. | **General Industry Machinery Repairing** |
| 630.884 | Anode Man (ore dressing, smelting, and refining) |
|  | Equipment Cleaner and Tester (ore dressing, smelting, and refining) |
|  | Pump Installer (any industry) |
| 631. | **Powerplant Machinery Repairing** |
| 631.884 | Hydroelectric Machinery Mechanic Helper (light, heat, and power) |
| 632. | **Ordnance and Accessory Repairing** |
| 632.884 | Gymnasticator Operator (firearms) |
| 637. | **Utility Equipment Repairing** |
| 637.884 | Air Conditioning Mechanic Helper, Commercial (any industry) |
|  | Pump Erector Helper (construction) |

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| 71 | **Fabrication and Repair of Scientific and Medical Apparatus, Photographic and Optical Goods, Watches and Clocks, and Related Products** |
| 710. | **Fabrication and Repair of Instruments for Measuring, Controlling, and Indicating Physical Characteristics** |
| 710.884 | Bellows Charger (instrument and applied)<br>Channel Tester (light, heat, and power)<br>Frequency Meter Aligner (electronics)<br>Gas Governor Repairman (light, heat, and power; petroleum refining; pipe lines)<br>Thermostat Assembler (instrument and applied) |
| 72 | **Assembly and Repair of Electrical Equipment** |
| 723. | **Assembly and Repair of Electrical Appliances and Fixtures** |
| 723.884 | Assembler, Carbide Lamp (light fixtures) |
| 724. | **Winding and Assembly of Coils, Magnets, Armatures, and Related Products** |
| 724.884 | Field Coil Repairman (electrical equipment) |
| 728. | **Fabrication of Electrical Wire and Cable** |
| 728.884 | Assembler, Electrical Wire Group (aircraft manufacturing)<br>Electrical Line Splicer (petroleum production)<br>Spark Tester (electrical equipment; insulated wire) |
| 73 | **Fabrication and Repair of Products Made from Assorted Materials** |
| 737. | **Fabrication of Ammunition, Fireworks, Explosives, and Related Products** |
| 737.884 | Cardox Plant Operator (mining and quarrying)<br>Fuse Assembler (ammunition)<br>Inspector, Salvage (ammunition)<br>Powderman (ammunition) |
| 81 | **Welding, Flame Cutting, and Related Work** |
| 810. | **Arc Welding** |
| 810.884 | Welder, Arc (welding)<br>Boilermaker Welder (boilermaking)<br>Welder, Atomic (welding)<br>Welder, Hand, Submerged Arc (welding) |

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| **82** | **Electrical Assembling, Installing, and Repairing** |
| **821.** | **Transmission and Distribution Line and Circuit Assembly, Installation, and Repair** |
| 821.884 | Electric Meter Installer (light, heat, and power)<br>Wireman, Street Light (light, heat, and power) |
| **822.** | **Wire Communication, Detection, and Signaling Equipment Assembly, Installation, and Repair** |
| 822.884 | Cable Man (telephone and telegraph)<br>Protective Signal Installer Helper (business services)<br>Protective Signal Repairman Helper (business services) |
| **823.** | **Electronic Communication, Detection, and Signaling Equipment Assembly, Installation, and Repair** |
| 823.884 | Antenna Installer (any industry) |
| **824.** | **Lighting Equipment and Building Wiring Assembly, Installation, and Repair, not elsewhere classified** |
| 824.884 | Electrician, Studio (motion pictures)<br>Street Light Repairman Helper (light, heat, and power) |
| **829.** | **Assembly, Installation, and Repair of Electrical Products, not elsewhere classified** |
| 829.884 | Cable Puller (construction; light, heat, and power; telephone and telegraph)<br>Elevator Repairman Helper (any industry) |
| **86** | **Construction Work, not elsewhere classified** |
| **862.** | **Plumbing, Gas Fitting, Steam Fitting, and Related Work** |
| 862.884 | Fitter (construction; pipe lines)<br>Hydrant and Valve Maintenance Man (waterworks)<br>Hydrant and Valve Setter (construction)<br>Pipe Fitter Helper (construction)<br>Furnaceman Helper (light, heat, and power)<br>Gas Fitter Helper (construction)<br>Pipeline Worker (construction)<br>Plumber Helper (construction)<br>Sewer Tapper (construction) |
| **863.** | **Asbestos and Insulation Work** |
| 863.884 | Fireproofing Man (light, heat, and power)<br>Insulation Hoseman (construction; retail trades, wholesale trades)<br>Insulation Installer (construction)<br>Sider (construction; retail trade) |

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| 866. | **Roofing and Related Work** |
| 866.884 | Corrugated Sheet Material Sheeter (construction) |
| | Roofer, Vinyl Coating (construction) |
| 869. | **Miscellaneous Construction Work, not elsewhere classified** |
| 869.884 | Awning Hanger (canvas goods; construction; retail trade) |
| | Billboard Erector Helper (construction) |
| | Brattice Man (mining and quarrying) |
| | Fence Erector (construction) |
| | Form Setter, Steel Forms (construction) |
| | Joist Setter, Adjustable Steel (construction) |
| | Lawn Sprinkler Installer (construction) |
| | Lightning Rod Erector (construction) |
| | Rig Builder (petroleum production) |
| | Sign Erector (signs) |
| | Wrecker (construction) |
| 89 | **Structural Work, not elsewhere classified** |
| 891. | **Structural Maintenance, not elsewhere classified** |
| 891.884 | Building Cleaner, Sandblaster (construction) |
| | Building Cleaner, Steam (construction) |
| | Dockman (ship and boat building and repair) |
| | Pipe Changer (mining and quarrying) |
| 899. | **Miscellaneous Structural Work, not elsewhere classified** |
| 899.884 | Chimney Repairman (business services) |
| | Pipeliner (pipe lines) |
| | Sewer Pipe Cleaner (business services) |
| | Shaftman (mining and quarrying) |
| 93 | **Extraction of Minerals** |
| 931. | **Blasting** |
| 931.884 | Blaster, Airdox (mining and quarrying) |
| | Dumper-Bailer Operator (petroleum production) |
| | Gun Perforator Loader (petroleum production) |
| 939. | **Extraction of Minerals, not elsewhere classified** |
| 939.884 | Acidizer Helper (petroleum production) |
| | Formation Fracturing Operator Helper (petroleum production) |
| | Lampman (mining and quarrying) |
| | Miner, Placer (mining and quarrying) |
| | Observer Helper, Seismic Prospecting (petroleum production) |
| | Shoreman, Dredge or Barge (mining and quarrying) |

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| **94** | **Logging** |
| 940. | **Timber Cutting and Related Work** |
| 940.884 | Bucker (logging) |
| | Faller (logging) |
| | Limber (logging) |
| | Logger, All-Round (logging) |
| | Pole and Piling Cutter (logging) |
| | River (logging; sawmill) |
| 95 | **Production and Distribution of Utilities** |
| 952. | **Generation, Transmission, and Distribution of Electric Light and Power** |
| 952.884 | Cable Maintenance Man (light, heat, and power) |
| | Trouble Man (light, heat, and power) |
| 954. | **Filtration, Purification, and Distribution of Water** |
| 954.884 | Turn-Off-and-On Man (waterworks) |
| | Water Meter Installer (waterworks) |
| 959. | **Production and Distribution of Utilities, not elsewhere classified** |
| 959.884 | Pole Framer (light, heat, and power; telephone and telegraph; wood preserving) |
| | Tree Trimmer (light, heat, and power; telephone and telegraph) |
| 96 | **Amusement, Recreation, and Motion Picture Work, not elsewhere classified** |
| 964. | **Theatrical and Related Entertainment Production, not elsewhere classified** |
| 964.884 | Acrobatic Rigger (amusement and recreation) |
| | High Rigging Man (amusement and recreation) |
| 969. | **Miscellaneous Amusement, Recreation, and Motion Picture Work, not elsewhere classified** |
| 969.884 | Fireworks Man (fireworks) |